School Shop

vol. III no. 3
November, 1943

How Trade Teachers Can Help PIT
by Thomas Diamond

Teaching Shop Students How to Plan
by Robert E. Smith

One-Tube Radio Set
by Ralph O. Williams

Draftsmen, What of the Future?
by Stuart McLoughlin

Shop Tested Projects ● News from Industry ● from Washington ● Strictly Personal ● News

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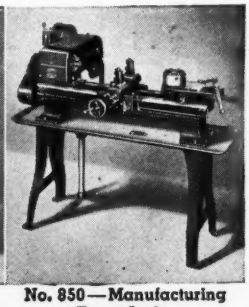

No. 850—Manufacturing Turret Lathe

The Cover . . . . .

Preinduction training means saving the lives of our young men and a quicker ending of the war. Aircraft engine mechanics is one of the courses, material for which has been worked out by the War Department and U. S. Office of Education. The significance of this type of training is obvious in the picture on this month's cover of Sergeant Jim Davison of Chicago, Ill., doggedly repairing the motor of a plane damaged in a dog fight when a large force of Jap bombers, escorted by Zeros, attacked his base somewhere in New Guinea.

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School Shop

FOR INDUSTRIAL ARTS & VOCATIONAL EDUCATION TEACHERS

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How Trade Teachers Can Help P.I.T.

BY *Thomas Diamond*

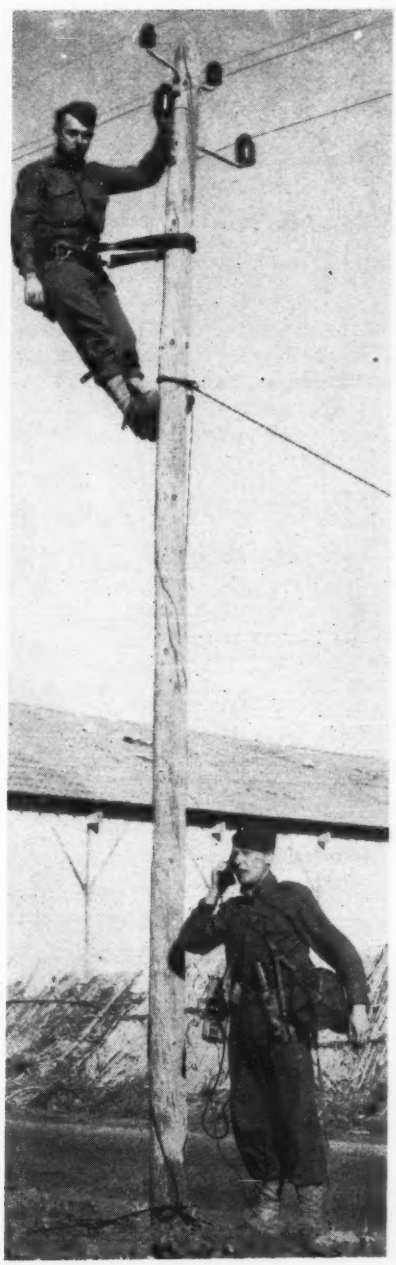
THE War Department and the United States Office of Education are cooperating with the public schools in preparing young men for the training they will receive after they are inducted into the Army. As a part of this cooperative effort a bulletin was published a few weeks ago in which suggestions were made for the guidance of school administrators in organizing preinduction training courses. In this publication—*Pre-Induction Training in Vocational Schools, Vocational Departments, and Trade Schools, P.I.T. 330*—it was announced that supplementary bulletins, containing suggestions for teachers, would be issued later. Four of these supplements are now available and may be obtained through your State Department for Vocational Education, or directly from the office of the Civilian, Pre-Induction Training Branch, Hq. Army Service Forces, Pentagon Building, Washington, D. C. The titles and numbers of these are as follows:

P.I.T. 331—Pre-Induction Vocational Training in Auto Mechanics
P.I.T. 332—Pre-Induction Vocational Training in Machine Shop Practice
P.I.T. 333—Pre-Induction Vocational Training in Aircraft Maintenance
P.I.T. 334—Pre-Induction Vocational Training in Electrical Signal Communication

Those responsible for the preparation of the bulletins have taken it for granted that each trade teacher has a thorough knowledge of the field in which he teaches. Furthermore, they have assumed that each teacher has a course of study which has been constructed to meet the particular conditions prevailing in his school. In view of this it will be noted that care has been taken to avoid telling the teacher what he should teach. Furthermore, since it was recognized that no single course of study could be developed which would meet the requirements of every school or class, courses of study have been omitted.

While these assumptions are sound in most cases, it is likely that few teachers are familiar with the specific tasks, related to their fields, which the soldier is called on to perform in order to keep the military machine functioning efficiently. In view of this it was felt that if the teacher were informed concerning what each soldier does in the Army, his knowledge of his trade would enable him to determine which parts of that trade would be most helpful to the soldier in meeting his responsibilities in battle.

Preinduction training is not an academic subject for discussion. It is a way to help high-school youth prepare themselves for the grim business of keeping themselves and their comrades alive and for the hard task of winning this war. Pictured below are two soldiers tapping an enemy communication line during the battle of North Africa. The skills they use are the same ones discussed in PIT 334. Shop teachers should be doing their part in this program every day. The author is Professor of Vocational Education at the University of Michigan, and Consulting Editor of SCHOOL SHOP.



In each bulletin there will be found a list of Army specialist jobs in the field to which the publication is related. These jobs were selected on the ground that public schools might provide some preparatory training for them. Each job in the list has been given a reference letter which is used later in the bulletin in relation to units of instruction.

Following this list, complete specifications are given for each job. These specifications have been taken from Official Army Regulations and describe accurately what the soldier does. It is hoped that these descriptions will be helpful to the teacher in pointing his instruction toward some definite Army goal. This does not mean that he must change completely what he has been teaching. However, they should direct his attention to those phases of his subject which should receive relatively greater emphasis.

The next section contains a series of units of instruction which are likely to be found in any of our larger vocational schools. Each of these units has a direct bearing on certain Army specialist jobs. These relationships are indicated by placing before each unit the reference letters of the jobs to which it has some application. By this means, when a teacher teaches a unit, he is aware of the specific jobs in the Army to which the unit is related.

It is probable that teachers in our larger vocational schools have excellent teaching aids as well as most of the up-to-date reference material obtainable. In some situations, however, teachers will welcome the suggestions given which are designed to aid them in their teaching job. The list of references is somewhat limited since it is confined to technical manuals issued by the Army. However, in each field represented, reference is made to a more extensive list of aids which may be obtained from the United States Office of Education.

From this it should be clear that the War Department considers each teacher to be a free agent. He may choose what he wishes to teach, he may teach it in the order that he considers most convenient, and he may use whatever method he considers to be suitable. It

Repairing a propeller mount of a P-38 requires skills that can be taught in PIT courses in vocational schools. Your boys may soon be overseas with a similar problem.

PIT 333 is concerned with the problem confronting these soldiers in the battle of North Africa who must get a shell-damaged P-38 back into the air with minimum delay.

is hoped however that what he does will make a contribution to the preparation of young people for more effective participation in the training program provided by the Army.

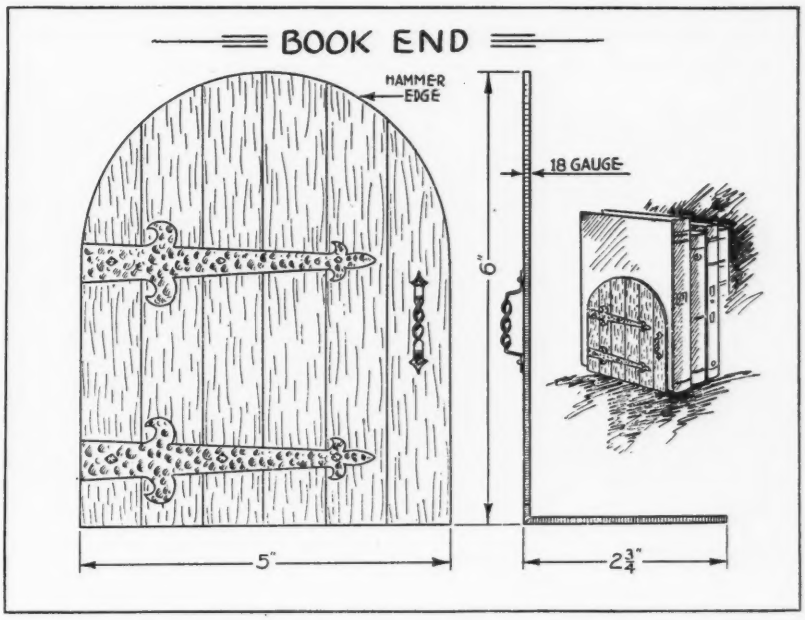
Since we are at war, and since every teacher wishes to make some contribution to the war effort, these bulletins should be received with enthusiasm by those who are teaching in the areas covered. If a teacher uses the information provided in them, not only will he teach his subject, but he will have the profound satisfaction that he is appreciably shortening the time it will take for the Army to prepare young men for actual participation in the war and bring its end that much sooner.

This emergency repair truck is equipped to service any gun from a howitzer to a pistol. These soldiers, stationed in the South Pacific, have to possess the skills outlined in PIT 332 or some soldier's gun won't fire when the enemy is firing at him.

Teaching Shop Students How to Plan

BY *Robert E. Smith*

In this article, the second of a series, Dr. Smith offers suggestions for starting a beginners' class in industrial arts and indicates how the purposes, outlined in the first of the series published in the October issue of SCHOOL SHOP, are incorporated in the selection of the projects and the teaching technics. The third and final article of the series, to be published in the December issue, will be concerned with improving teaching in advanced classes.



IN planning work for a beginners' class in industrial arts, the purposes of work in the laboratory should be carefully incorporated in the projects. The chief purposes of laboratory work are: to acquaint students with the nature and the use of tools and equipment commonly used in industry, to aid students in acquiring skills in shop work, to teach students how to attack problems analytically and methodically, to aid students to make decisions on the basis of facts or of possible or probable consequences, and to instill habits of industriousness, thoughtfulness, orderliness, perseverance, and tolerance.

Certain decisions must be made by the teacher preliminary to the first class meeting. These will certainly take into consideration the maturity and past experience of the students and their physical development and, also, the availability of tools, equipment, and stock. The instructor must decide whether he will start the students working in all the areas available, in a single area, or in two or three of the areas. It seems to the writer that decision to limit the range of activities of a beginners' class to two or three areas can be fully justified on the basis of need for careful, frequent, and adequate instruction and supervision, and, further, on the basis that all students may thus be put to work promptly thereby using the student's time well and maintaining his interest.

The instructor must also decide how the project is to be selected: whether it is to be assigned by the instructor, whether the class is to be permitted to select, by majority vote, one of several projects submitted in drawing or model form, or whether to allow free election on the basis of individual student interest. The writer prefers to submit drawings of several projects to the class, because such participation enlists at the outset the student's interest. Free election, while enlisting individual interest and giving him opportunity to determine his own educational program, has the disadvantage of requiring more individual instruction than the teacher has time to give and, also, presents problems in skills and use of tools outside the student's experience.

The first class meeting might well be given over to acquainting students with the purpose of the work, the areas in which the work is to be undertaken, the equipment and supplies, conduct in the laboratory, and routine assignments. Tools and equipment might be examined and the teacher might demonstrate how these are to be handled.

The project might be selected at the beginning of the second period. After it has been selected, the teacher should explain and show the need for a plan of procedure. He should explain that a competent workman always plans his work before he starts ordering or cutting material. Let us assume that bookends are selected as the project. The teacher may engage the class in discussion as to what must first be done. It will soon be obvious, through the teacher's guidance, that a drawing or sketch is the proper preliminary step. Procedures for drawing then come for attention: size of the drawing, type of paper to be used for it, whether free-hand drawing would be adequate, whether drawing instruments should be used, whether plain or lined paper should be used, how the paper is to be fastened to the drawing board, and how pencil, ruler, etc., are to be used. After the object has been outlined and contour and surface refinements discussed, the subject of dimensions is brought up, and the teacher has opportunity to explain the purpose of dimensioning and to demonstrate the technic. The finished drawing is carefully checked for accuracy by the student and teacher.

The student should then be confronted with the necessity of making out a bill of materials. The problem will naturally arise while the class discusses the step following a drawing of the project. What kind of metal should be selected? Brass, copper, aluminum, tin, zinc, and sheet iron will be suggested, all of which afford the teacher opportunity to discuss suitability of these metals, their availability, and their costs. It may be decided, finally, that 18-gauge black sheet iron be used since it is suitable, available, and inexpensive. How much will the class need? This reemphasizes the value of a plan, the need for dimensions, and, also, the need for a "bill of materials." The teacher now has on the blackboard and the students have on their procedure list two steps: (1) make a drawing or sketch of the object; (2) make a bill of material. A form on which bills of material are made out should be distributed and the purpose and use explained. The accepted method of making entries should be demon-

strated, and the reason for using conventional nomenclature and form should be given.

Further analysis of the project with the students will complete a list of 21 further steps: (3) select the stock; (4) lay out and cut stock; (5) smooth one edge of each piece and file; (6) smooth and square one end of each piece with the smoothed edge; (7) lay out the design of the object or parts on the piece of metal; (8) cut each piece of stock to shape with tinsnips or other tools; (9) smooth all cut faces with a file; (10) peen one surface of each hinge with a ball-peen hammer; (11) locate and drill holes for rivets in hinges; (12) locate and draw straight lines on upright part of each bookend; (13) locate position of hinges on bookend and drill holes; (14) rivet hinges in position; (15) twist and shape handles; (16) locate and drill holes in handle; (17) rivet handle in position; (18) bend the foot of each bookend at the point indicated in the layout; (19) test each bookend for squareness; (20) polish exposed surfaces with fine steel wool; (21) shellac a piece of felt on bottom of each bookend; (22) apply an even coat of clear lacquer to the exposed surfaces of each bookend; (23) check dimensions with dimensions given on drawing, estimate quality of your work, then submit finished work to instructor.

The student-made copy of these 23 steps should be attached to his drawing. In subsequent projects, students, as they make more suggestions, should become more reliant in making out their own plans.

This list of procedures will suggest to the instructor the necessity for explanations and demonstrations. In step 4, for instance, the instructor will have occasion to emphasize the need for care, thought, economies to be observed in cutting stock to avoid injury, waste, and spoilage. The instructor here will also show how to hold the tools, reasons for so doing, how to operate, for example, the tinsnips so as to make intelligent application of the principles of leverage, how to turn the snips to change the direction of the cut, and how to control the tool when approaching the terminal of the cut.

Here are a few considerations drawn from the writer's experience in shop teaching:

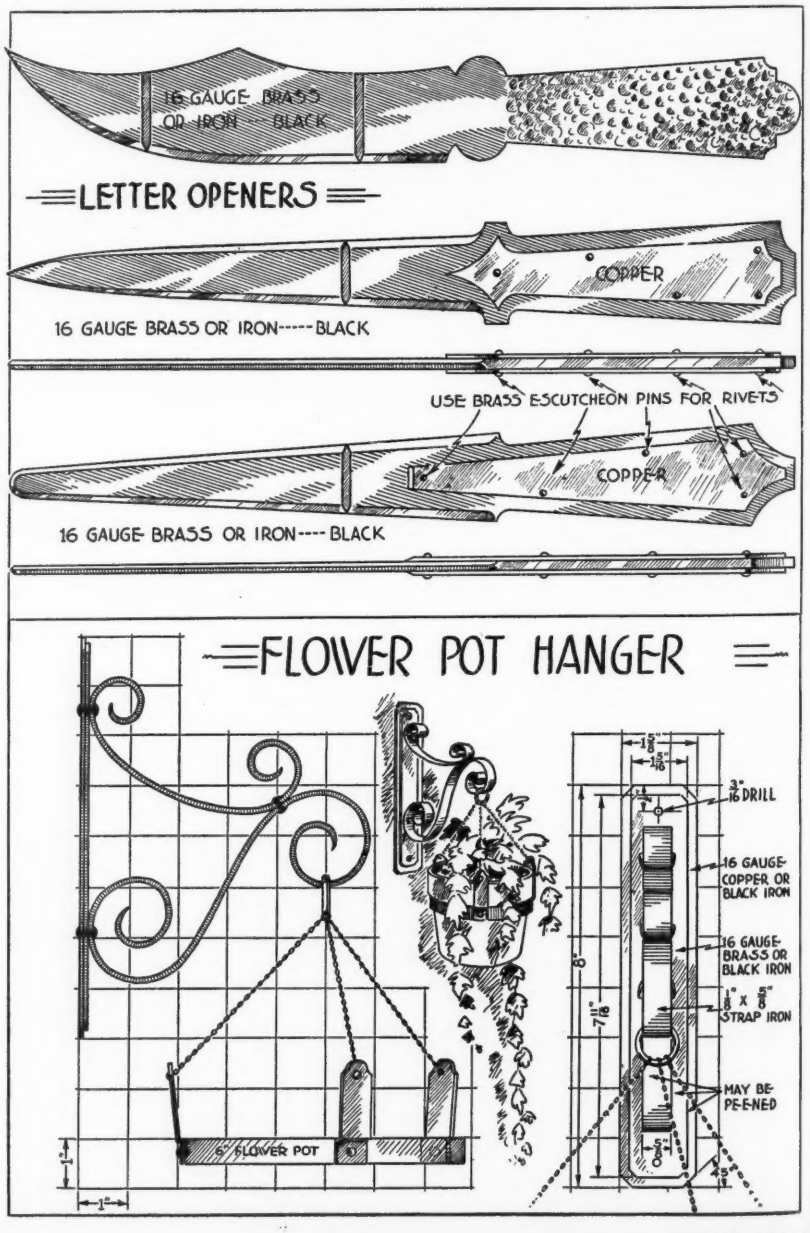
Procedures and technics which seem simple to the instructor are new to beginners, and unless the instructor keeps this in mind he is apt to cause much confusion, uncertainty, and misunderstanding.

Not more than one or two steps, principles, or operations should be demonstrated at one time and the student should be given opportunity to put into practice immediately what has been demonstrated to him.

As the group progresses, attention may increasingly be directed to presentation of information concerning tools, equipment, materials, occupations in the area of activity, how workers in the area serve mankind, educational requirements and source of training, etc.

A personnel system through which duties are assigned is helpful in teaching students to assume responsibilities for properly caring for, storing, and cleaning equipment, storing and distributing supplies, checking attendance, acting as group leaders, and performing shop routines.

The assignment of from one to four advanced and capable students as leaders or foremen in beginning classes enables the instructor to furnish closer supervision and individual experience and affords the advanced student excellent experience in working with people and greatly increases his knowledge of tools, equipment, and materials.



The drawings of three projects accompanying this article are suggested by the author for beginners in industrial arts. Each has incorporated certain principles of design and is useful for introducing planning procedures, drawings, tools, and materials.

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Project of the month:

One-Tube Radio Set

A Laboratory Project for a Radio Fundamentals Course

BY *Ralph O. Williams*

Teachers of preinduction training courses will find this an excellent project requiring a minimum outlay of equipment. The author is a member of the faculty of Western Michigan College of Education, Kalamazoo, a member of the Institute of Radio Engineers, and holds an amateur Class A license as well as commercial licenses for both radiotelephone and radiotelegraph.

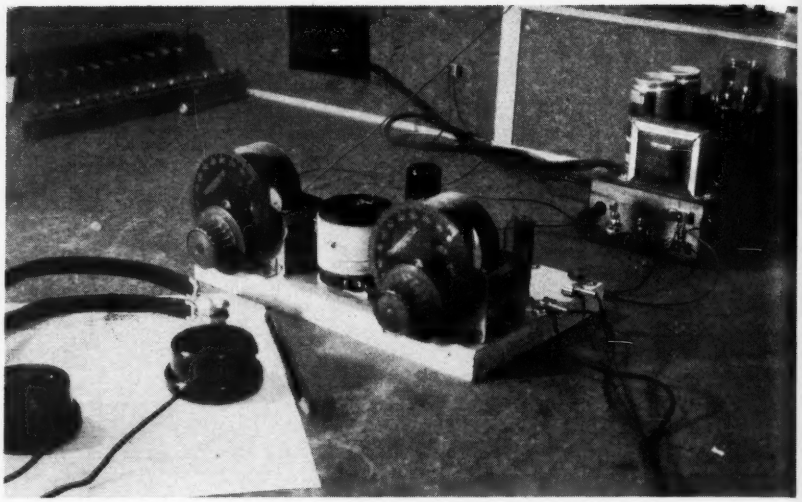

FIG. 1.—This one-tube receiver provides plenty of headphone volume and can be built from parts of old radios. The condensers in this set are from an old Freshman-Masterpiece. The separate power supply is in the background.

TESTED INSTRUCTIONAL PROJECT

To hold the interest of a student while studying the fundamentals of radio it is important that he be given a certain amount of shop work. He is interested in radio because he wants ultimately to get his hands on apparatus and wants to construct, operate, and maintain communications equipment. If his interests are purely academic his education will not be complete unless he can actually assemble a working model of something.

The first shop work of a student in radio must consist of learning to solder, connect wires to terminals, read simple schematic wiring diagrams, and follow wiring charts. At the same time he should be studying basic electricity such as direct currents, alternating currents, and elementary vacuum-tube theory. With this training the student should be ready to undertake the project outlined below.

The one-tube set to be described was designed for the students to build as a part of their shop work in a course of radio fundamentals at Western Michigan College. It has excellent performance characteristics, will receive either standard broadcasts or short waves depending upon coil size, has plenty of headphone volume, is inexpensive to make and can be built from junk parts found in old broadcast receivers. (See Fig. 1.)

By the addition of a telegraph key or a microphone this receiver may also be used as a low powered transmitter in the laboratory and thus provide two-way communication between students.

It is not only a great thrill to build the receiver and tune in stations, but it fills one with a feeling of satisfaction and mastery to know that with his own hands and a few old radio parts he can build a device that will tune in local or distant stations on any frequency.

FIG. 2.—Several one-tube sets built from salvaged radio parts. All sets follow the same general plan of layout and work equally well. Notice the large variation in the size and kinds of coils, condensers, and dials.

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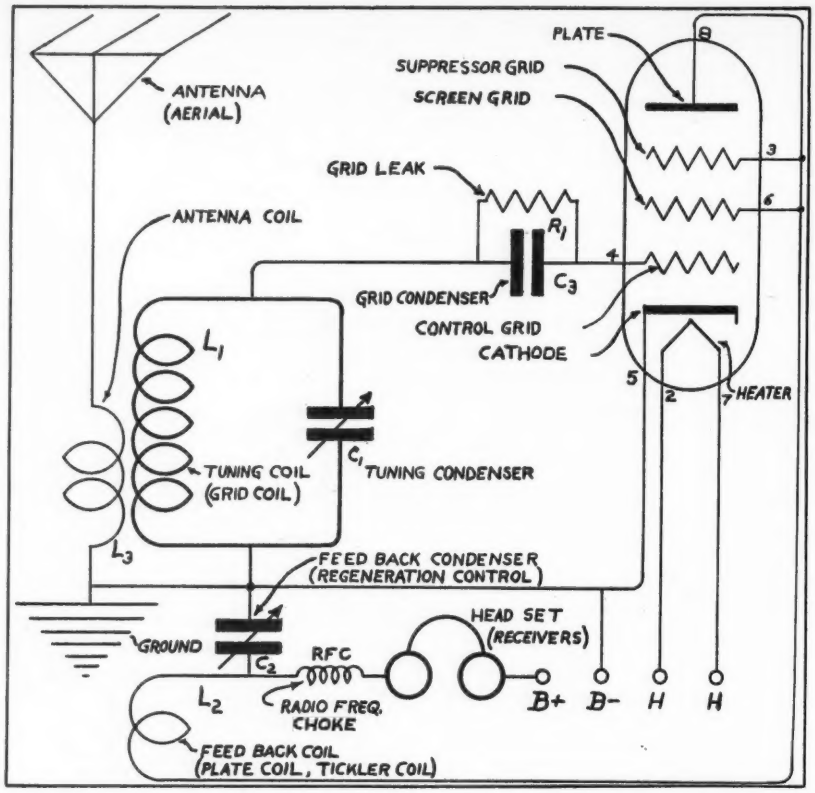

FIG. 3.—Schematic wiring diagram of the one-tube receiver. This modern version of the old reliable regenerative detector uses capacity control of magnetic feed-back. The operating frequency is controlled by the number of turns on coil L_1 and the capacity setting of the condenser C_1.

Instructional Features

The set should provide the student with the opportunity to practice many skills as well as test his knowledge of basic electricity and radio theory. The following suggested activities center around the construction and testing of the one-tube set.

The trainee may obtain experience in: (1) Making a bill of material and ordering parts and supplies. (2) The use of hand tools in shaping and assembling of the parts. (3) Practice soldering and wiring from diagrams. (4) Circuit tracing and reading schematic drawings. (5) Use of the Ohmmeter in checking circuit continuity. (6) Inspection of a finished product for final approval. (7) Connecting batteries, antenna, and headphones according to specific instructions. (8) Trouble-shooting if set fails to operate. (9) Tuning in a station properly and correct adjustments of the tuning controls for optimum operation of the receiver for the reception of either code or voice. (10) With antenna coupling, observe signal strength and selectivity. (11) Study of relation between coil size, condenser capacity and frequency. ($X_L = X_C$ for resonance.) (12) Experiments with feed-back required for oscillation and examination of feed-back (tickler) coil turns v.s. condenser capacity. (13) Study of the use and effect of the R. F. choke. (14) Effect of correct polarity on sensitivity of headphones. (15) Study of detector characteristics and effect of size of grid-leak. (16) Study of oscillation, its effect on received signals, and plate and grid current of tube. (17) Experiments with heterodyning of signals on nearly the same frequency and zero-beat conditions. The production of audio frequencies from two radio frequencies. (18) Experiments in measuring radio frequency with wavemeters and the calibration of wavemeters by the use of the receiver. (19) Use of signal generator in calibrating dial of receiver. (20) Use of receiver to check accuracy of signal generator against the National Bureau of Standard's Station WWV in Washington, operating on a frequency of 5000 Kc. day and night. (21) Experiments in impedance matching using audio transformer between set and headphones. (22) Code practice transmitters and receivers to be used without any antenna in the laboratory for communication between students. (Note: The Federal Communications Commission forbids the use of unlicensed transmitters under penalty of a $10,000 fine and/or two years in prison. Radiations from these devices must be from the coils only with no antenna attached and with low enough battery power so they can be heard only a hundred feet or so.)

The number of experiments and demonstrations that may be performed with one or more receivers depends only on the comprehensiveness of the radio course and the ingenuity of the instructor.

Circuit Description

The circuit shown in Fig. 3 is an old timer. It is the time-tested regenerative detector using a capacity controlled magnetic feed-back arrangement. It is sometimes called the Armstrong tuned-grid circuit. Feed-back (regeneration) is controlled by the adjustment of a variable condenser and does not affect the tuning. The sharp cut-off pentode (6SJ7) in a triode connection proved to be an excellent tube for this application.

Technical Description and Operating Theory

The vacuum tube, type 6SJ7, is triode connected. Tuned circuit L_1C_1 controls the frequency. Coil L_2 provides magnetic feed-back (regeneration) from the plate circuit to the grid circuit. The radio-frequency choke (R.F.C.) restricts the flow of alternating current at the signal frequency and thus makes it necessary for energy to be transmitted to the ground through C_2, controlling the feed-back. Current through L_2 sets up magnetic lines of force which link it to L_1 and thus provides the regeneration. A signal enters the system through the antenna to the ground circuit setting up magnetic lines linking the antenna coil with the grid coil and causing currents to be set up in the "tank" circuit L_1C_1. When the grid circuit is tuned to a signal, circulating electrons in the tank circuit set up potentials across it at the signal frequency. These small voltages are impressed on the grid-cathode circuit of the vacuum tube and since the grid leak R_1 connects the grid with the cathode, these voltages may be said to appear across the grid resistor.

Half cycles of the signal frequency appearing across the grid resistor are rectified by the vacuum tube and result in currents which flow down the grid resistor to the cathode. The direct current produced by the rectification is pulsating at the radio-frequency rate and is changing in amplitude in accord with the audio-frequency modulation. We have then two currents in the resistor, radio frequency and audio frequency. Varying voltages across the

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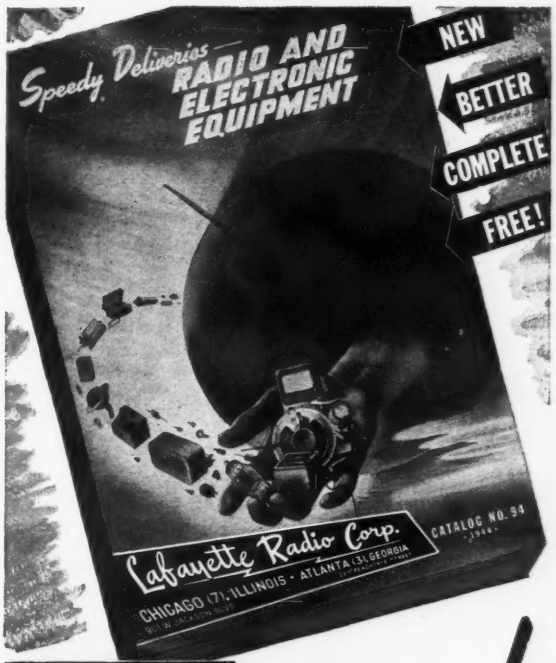

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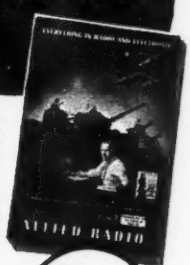

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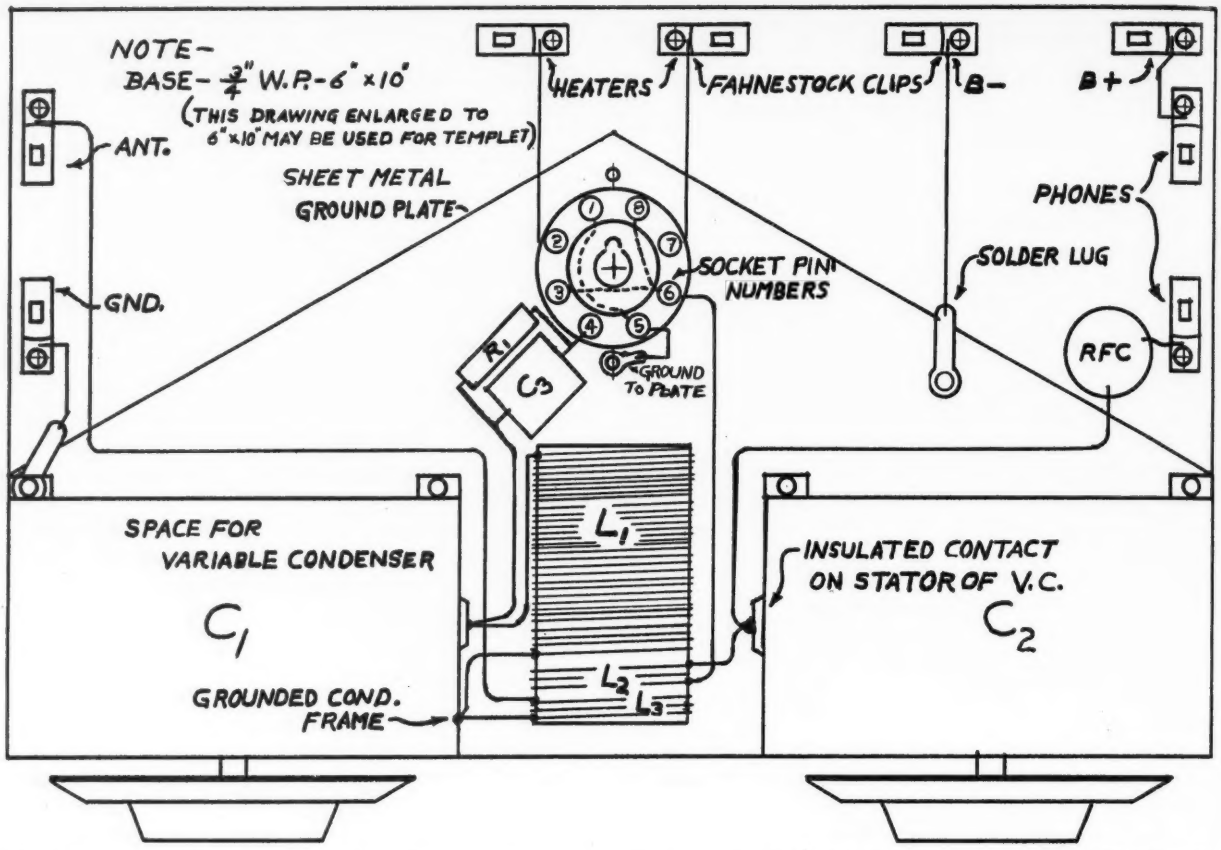


FIG. 4.—This pictorial wiring diagram shows the arrangement of parts on the baseboard. The placement of wiring is very important and should be followed closely. Dotted lines indicate connections made before socket is mounted. Follow closely the polarity of the connections to coils L_1 and L_2.

grid-leak are impressed on the grid and affect the plate current of the tube and therefore the current through the headphones. The receivers will not respond to the radio frequencies which are mostly by-passed by the capacity of the cords, so the radio-frequency component of the current is unused, except for regenerative purposes in coil L_2. The telephones will respond to the audio-frequency modulation of the plate current and the diaphragms vibrate in response to the variations in plate current which result from the changing amplitude of the radio frequency voltages across the grid-leak. Grid condenser C_3 is simply a blocking condenser transferring energy to the grid but blocking the direct current path to the ground so the rectified current is forced to pass down through the grid leak resulting in potential to operate the tube. The tube is really used as a detector-amplifier. The function of detection takes place in the grid circuit using the grid and cathode as a diode. Amplification takes place in the triode as a whole deriving its driving power from the rectified voltages across the grid leak which serves also as the grid resistor of the amplifier.

Regeneration results from radio-frequency energy which is by-passed to ground from the plate circuit through L_2C_2. These currents provide magnetism for feed-back and by adjustment of C_2 the required amount of energy can be transferred back to the grid circuit to overcome its losses and thus increase the efficiency of the circuit as a whole. If more than enough power is fed back the circuit will start to oscillate, that is, generate radio-frequency power of its own. It is then that the receiver becomes a transmitter and is capable of causing interference with other receivers and causes a squeal in the headphones when signals are tuned in. The squeal is called a heterodyne and since the circuit produces it automatically it is sometimes called an auto-dyne circuit. For voice reception it is best to operate the receiver just below the point of oscillation in order to obtain maximum selectivity and volume.

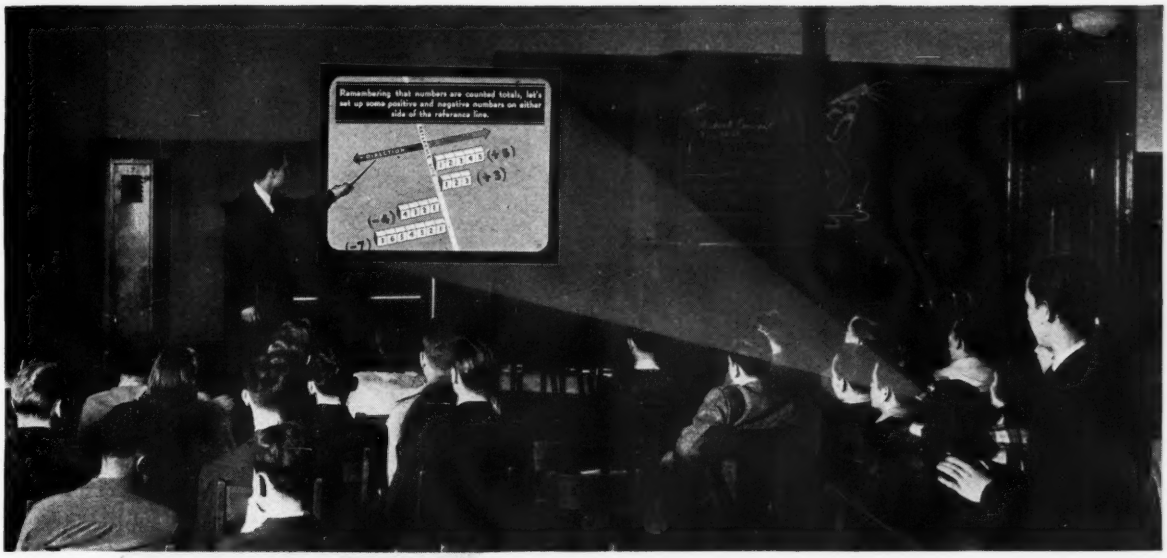
Construction

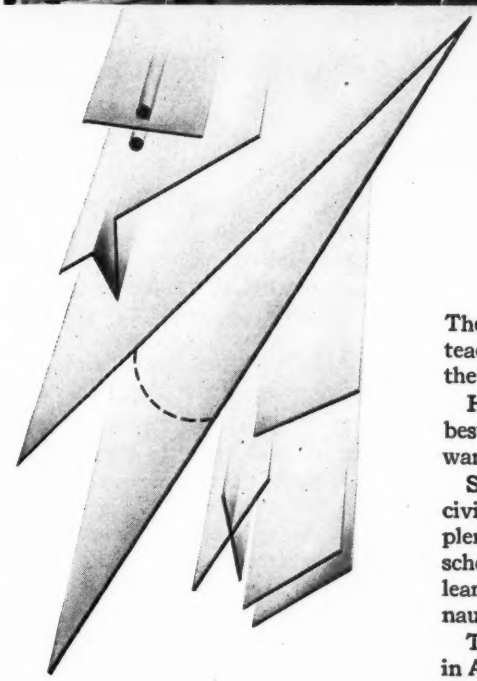
Although the specifications list certain parts the instructor may substitute others of equal or approximately equal electrical characteristics although not of the same physical size or shape. For example almost any kind of a variable condenser may be used for C_1 and C_2 even if a change in base dimensions is required.

The sets shown in Fig. 2 were built from parts taken from old broadcast receivers, no two of which were alike.

Bill of Material

1 pc. wood, white pine "base-board," ¾" x 6" x 10".
1 pc. sheetmetal, 24 to 28 gauge, terne plate or flashing tin, 5" x 10".
14 screws, wood, blued, ¾" long. Round head.
5 screws, wood, blued, 1½" long. Round head.
4 solder-lugs, tinned.
1 socket, vacuum tube, octal, bakelite wafer.
2 bushings, stand-off, ¾" long cut from ¼" tubing.
8 fahnestock clips, small.
1 vacuum tube, Type 6SJ7.
1 resistor (grid leak), 1 to 3 megohms, ¼ watt carbon or insulated.
1 condenser, fixed mica, 100 to 250 micro-microfarads (.00025mfd.).
2 condensers, variable air, max. cap. 100 to 350 mmfd.
2 dials, 3" (for tuning condensers).
¼ lb. magnet wire, insulated No. 22 to No. 26, for coils.
¼ lb. magnet wire, insulated, very fine, around No. 36 to No. 40, for radio frequency choke (from old speaker fields).
1 pc. wood dowel, ½" x 3" (for radio frequency choke coil form).
1 pc. coil form, wood or fiber, 2" diam. x 3"


Remembering that numbers are counted totals, let's set up some positive and negative numbers on either side of the reference line.
(+5)
(+3)
(-4)
(-7)



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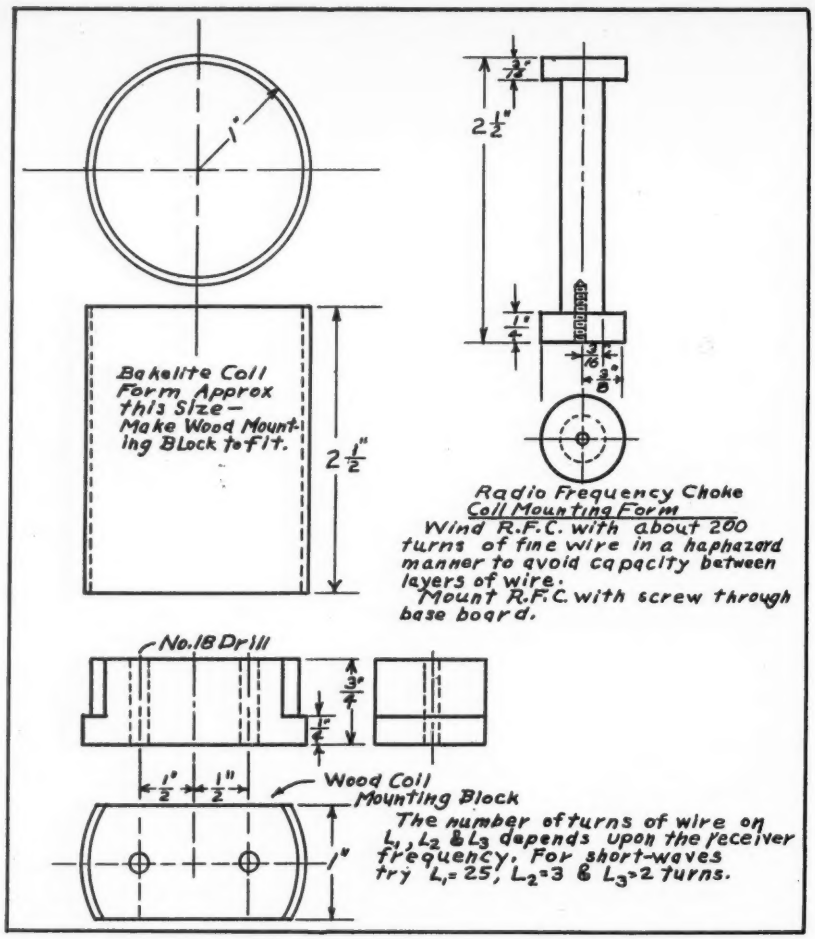
1"
Bakelite Coil Form Approx this Size— Make Wood Mounting Block to fit.
2 1/2"
2 1/2"
1"
3/16
3/8
Radio Frequency Choke Coil Mounting Form
Wind R.F.C. with about 200 turns of fine wire in a haphazard manner to avoid capacity between layers of wire.
Mount R.F.C. with screw through base board.
No. 18 Drill
3/4"
1"
1/2"
1"
1/2"
Wood Coil Mounting Block
The number of turns of wire on L1, L2 & L3 depends upon the receiver frequency. For short-waves try L1=25, L2=3 & L3=2 turns.
1"

FIG. 5.—Tuning-coil form, wood mounting block, and radio-frequency choke coil form. The coils shown are of a desirable size. Small variations in size are unimportant. The tuning coil form may be turned out of a solid block of wood if desired. It must then be boiled in paraffin to exclude all moisture.

long.
1 pr. headphones, high resistance, any make.

Construction Procedure

1. Cut out base board as shown in Fig. 4.

2. Cut out metal grounding plate as shown in Fig. 4.

3. Drill grounding plate and mark screw holes on wood base as indicated in illustration.

4. Prepare coil forms as shown in Fig. 5.

5. Wind choke coil as shown in Fig 5.

6. Wind tuning coils as shown in Fig. 5. Pay special attention to direction of winding and connections.

7. Mount parts as shown in Fig. 4.

8. Wire the circuit according to the schematic diagram of Fig. 2, and the pictorial wiring diagram of Fig. 4.

9. Check wiring and circuit continuity.

10. Connect headphones and antenna and test. (Be sure of headphone polarity connecting lead with red tracer to the plus side of the circuit and the negative lead to the plate side.)

Operating the Set

Successful operation of this set depends to a great extent on correct voltages and the operator's ability to "get the feel" of the controls. Hints on tuning follow:

1. The filament voltage should be 6.3 volts A. C. or D. C. and may be derived from a transformer connected to the A. C. power line or from an automobile 6-volt storage battery.

2. The plate, or "B," voltage must be direct current in the range of 90 to 135 volts. This may be secured from dry cell radio "B" batteries or from a vacuum tube rectifier type of high voltage power supply connected to the A. C. power mains. If the power supply voltage is too high it may be reduced by placing a voltage divider resistor across the high voltage and tapping off the "B" plus voltage for the set at around 100 volts.

3. Disconnect antenna and check for control of feed-back by rotating C_2 and listening for a "plop" or click as the condenser is rotated from low toward high capacity. On the high capacity side of the "plop" there should be a loud click when the lead of a pencil is touched to the grid side of C_1. *This is a test for oscillation.* There should be a negligible click when the condenser is on the low capacity side of the "plop." If the above conditions hold, the regeneration (feed-back) is normal and can be controlled by rotation of C_2. If however there is too much feed-back and a loud hissing and squealing noise is heard in spite of the position of C_2, two things could be wrong: there might be too many turns of wire on L_2 or the radio-frequency choke (R. F. C.) may have too few turns and not be effective. To test, put another similar coil in series with R. F. C. and observe the change in regeneration if any; also try cutting the number of turns on L_2 by one third or one half. If there is no oscillation at all it may be because L_2 is not properly connected in which case try reversing the connections to the coil; or possibly there are not enough turns on L_2 and an extra turn or two should be tried.

4. Always tune the receiver with both hands, one hand on C_1 and the other on C_2. Rotation of C_1 tunes in the station and careful adjustment of C_2 controls volume and selectivity. Always listen to voice and music with C_2 adjusted to the low capacity side of oscillation, and radio telegraph code with the set in an oscillating condition.

Modifications

Due to the present scarcity of modern types of vacuum tubes it may be difficult to obtain the 6SJ7 tubes in some places. Substitutes may be made by making proper socket connections or in some cases replacing the socket with one of a different type. In general any high gain triode, tetrode, or pentode having a sharp cut-off grid voltage plate current characteristic may be used. Notice that the 6SJ7 is triode connected. If other pentodes or tetrodes are used, they are also to be triode connected. If a tube of other than the 6-volt series is to be used, suitable filament voltage must be provided. Tube characteristics and socket connections may be found in information sheets put out by the tube manufacturers and obtainable from all dealers. One of the most complete and convenient sources of vacuum tube information is the R.C.A. receiving tube manual obtainable for twenty-five cents from the Radio Corporation of America Radiotron Division, Harrison, New Jersey.

The following substitutions are suggested: *(Continued on page 20)*

Strictly Personal...
ABOUT YOUR FELLOW TEACHERS

DEAN M. SCHWEICKHARD, assistant superintendent of schools, Minneapolis, Minn., has been appointed state commissioner of education for Minnesota . . . Sgt. HECTOR L. D'AMATO, former teacher of woodworking and printing in the Medford, Mass., schools, has been awarded the Purple Heart. He was wounded in action on Guadalcanal but is now back with his company somewhere in the South Pacific . . . JAMES VOYCE, formerly with the Michigan State Board in Control of Vocational Education, has been named educational director of Woodall Industries, Detroit . . . FRANK A. DUTCHER has been appointed teacher of industrial arts in the East Junior High School, Waterloo, Iowa . . . Among former shop teachers now in the Navy are CARLYLE ALLDREAD, Mesick, Mich.; CARL FURNEY, Leland, Mich.; MELBOURNE JOHNSON, Ludington, Mich.; HENRY BECKNER, Walton, Ind.; and HARVEY KULIBERT, Ann Arbor, Mich. . . . WILMER G. KIMES now teaches in the Eddystone, Pa., schools. He was formerly at Phoenixville, Pa. . . . ROBERT WEIR of Wyoming, Pa., now teaches industrial arts at State College High School, State College, Pa. . . . ARTHUR MARTIN, formerly of Dowagiac, Mich., has been named director of vocational education for the Benton Harbor, Mich., schools . . . WILLIAM MECHLIN, instructor of general shop, Easttown School, Berwyn, Pa., has been appointed instructor in woodworking, Tredyffrin-Easttown High School, Berwyn, succeeding JAMES W. WILLIAMS who has entered industry. ANTHONY YOST has taken Mr. Mechlin's position at Easttown School . . . NOEL T. MYERS is the new director of industrial education in the New Castle, Ind., schools, succeeding R. P. MCLEOD who has gone with the Perfect Circle Co. WILBUR STONER, former industrial arts teacher, is now teaching in Fort Wayne and his place has been taken by ROBERT MCGINNIS. C. S. KINDER of the Allison Aircraft Plant, Indianapolis, is now machine trades teacher . . . S. JAMES SENES, for 16 years a teacher of electricity and related trade subjects at Joliet, Ill., Township High School, has resigned to become assistant state supervisor of trade and industrial education for Illinois with headquarters at Springfield . . . CECIL A. WARNER of Mooers Central School, New York, has taken a position at Central Square, N.Y., High School . . . HARVEY W. WAFFLE of the Waukesha, Wis., High School faculty has taken a position as drawing instructor at the Davenport, Iowa, High School . . . WILLIS H. WAGNER of the Kansas City, Mo., schools has been appointed instructor in industrial arts at the Warrensburg, Mo., State Teachers College . . . NOBLE F. HARBAUGH, former teacher of drawing in the South Bend, Ind., schools, has been named instructor in engineering drawing at the University of Notre Dame . . . New shop teachers at the East Bakersfield, Calif., High School are LEONARD TATE and HENRY MINETTI . . . G. B. WESTERBERG, formerly at the Dundalk, Md., Junior High School, has been named teacher of industrial arts in the McDonogh School for Boys, McDonogh, Md. . . . AUGUSTINE FOSTER ROSE has retired as director of manual arts for the Providence, R. I., schools . . . KURT MEYER has joined the faculty of Maine Township High School, Des Plaines, Ill., as teacher of radio and electricity . . . AUGUSTINE E. WINNEMORE, printing instructor in Eastern High School, Washington, D. C., has joined the armed forces . . . J. B. YINGLING of Colorado State College, Fort Collins, has been appointed to the staff of the U. S. Office of Education in Washington.

HOW TO TORCH-BRAZE CARBIDE TIPS TO SHANKS AND GET TOOLS ON THE JOB FAST

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← After milling and grinding shank angles, mill recess in shank to fit carbide tips. Cut silver solder sheet (.003 thick) slightly larger than recess. Clean tip, sheet and recess with carbon tetrachloride.

Place shank in vise as shown. Apply flux liberally → to shank recess and well back of recess. Flux silver solder sheet; place in recess. Flux carbide tip; place in recess. Assembly now ready for brazing.

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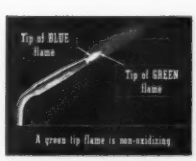
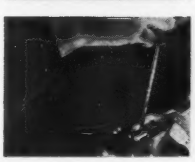


← Adjust oxy-acetylene torch to 10 lbs. pressure on both gages, with a tip of green flame and blue flame as shown.

Apply torch along → bottom. Keep moving. Then work around sides and end of shank. Avoid excessive, or spotty, heating.

← When solder melts and shank and tip become dull cherry red, direct flame on the tip.

Then take a hold- → ing rod and move tip back and forth to wipe in joint and distribute silver solder evenly.



← Now remove flame and press down squarely on tip. Heavy pressure not needed. Hold until silver solder sets.

Set tool aside and → allow to cool naturally. *Do not quench* in liquids as tip may crack.

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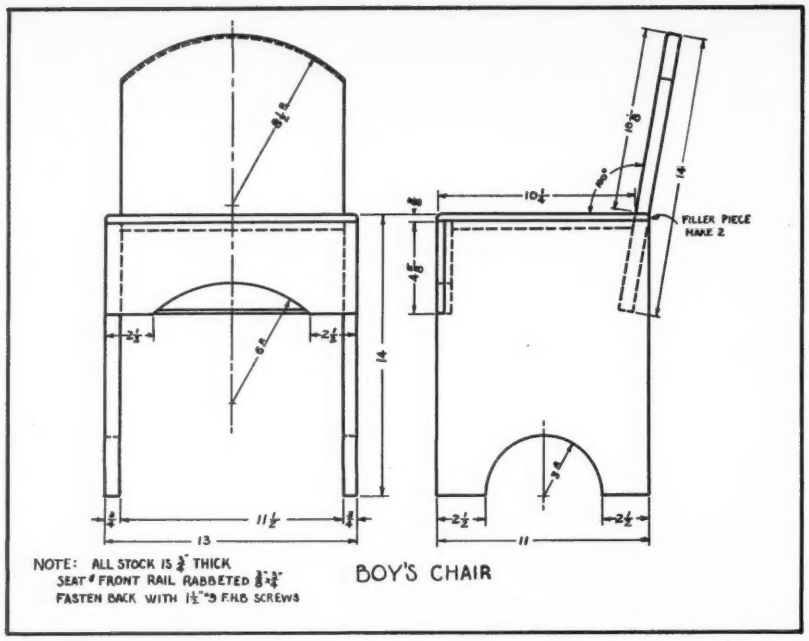

A Boy's Chair

BY *Harold L. Forsea* AND *Donald Cross*

TESTED INSTRUCTIONAL PROJECT

ANY boy with a yen for mechanical things has his room crowded with models and gadgets. Ordinary furniture "clutters" the place. Yet visiting neighborhood friends cannot be seated by dragging in the living-room chairs each time. Two or three of the small "occasional" chairs shown here meet the needs of his own room and take up less space than full-size chairs.

BILL OF MATERIAL FOR ONE CHAIR

Name of Pieces	*No. Needed*	*Size*
Seat	1	¾x10¼x13
Front Rail	1	¾x 4⅝x13
Sides	2	¾x11 x13⅝
Back	1	¾x11½x14
Fillers	2	⅜x ¾x ¾

Wood—Clear Pine

Cut the pieces to the finished dimensions shown with edges smooth and corners square. This will simplify the final assembly of the job.

Use ¾" pine stock throughout. Other woods are suitable, of course, depending on the finish desired.

Cut and square the seat to 10¼"x13"; when ripping to width, make the 10° bevel for fitting against the back. Cut and square the front rail to 4⅝"x13"; also saw out the curved part. Lay out and cut ⅜"x¾" rabbets on both ends of the front rail, both sides and front edge of the seat.

Fasten together the two pieces for the sides and square up to 11"x13⅝". Lay out and cut a ⅜"x4⅝" notch in the front edge to receive the front rail. Lay out and cut the curved design on the bottom.

Lay out and cut the back 11½"x14" using an 8½" radius for the curve. If a higher back is desired this piece should be made correspondingly longer to permit good fastening.

Smooth the curved edges of the front rail, the side pieces, and the back piece, using a wood file and sandpaper.

Make a trial assembly to check the fit of all parts. Make any changes necessary for close-fitting joints. Before fastening permanently, plane all surfaces lightly to remove millmarks. Now sandpaper both sides of the back and the inside surface of the sides as these are difficult to reach after assembly.

Assemble sides, seat, and front rail using glue and 6d finishing nails. Set the back in position to locate two wood screws on each side and two across the back. Fasten with 1½ No. 9 f.h.b. wood screws.

Make two filler pieces to fill in the space at the back corners of the seat. Fit and glue into place.

Test the chair on a flat surface and level the legs if necessary. Remove excess glue, trim, and round off the arrises on the seat. Sand all exposed surfaces carefully. Finish with a durable enamel.

The author, who teaches at Corning, Calif., Union High School, says this project "was worked out with the help of one of my students to meet a particular need of his own. It has since aroused a good deal of attention from others. It cuts to advantage from standard stock and has worked out well as a project for beginners in machine woodworking. The simple construction involves a number of fundamental machine processes on stock sufficiently large to be easily handled." Student planning and teacher guidance of a high order are clearly evident.

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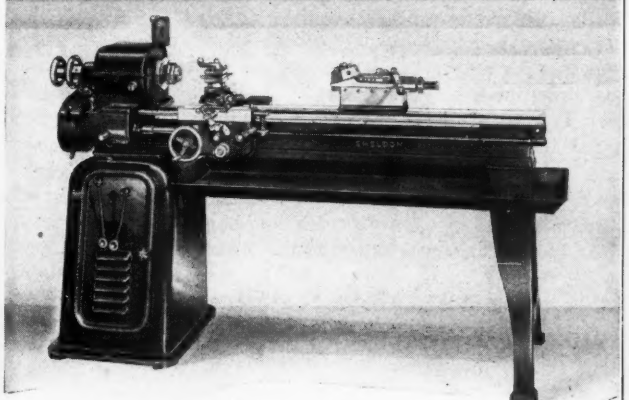

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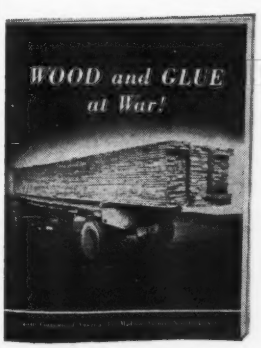

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Draftsmen, WHAT OF THE *Future?*

BY *Stuart McLoughlin*

WHILE our classes are deservedly popular and enrolments are overflowing because of the present emergency, are we keeping in mind the dull days ahead and the coming slow-down? Are we making preparations to meet the situation?

We should take every advantage of our present position to establish ourselves firmly in the minds and hearts of our patrons, students, and schools against a time when our subject may not be so much in demand. If the words of the Persian proverb, "In times of peace prepare for war" be true, then surely the reverse will be wisdom indeed for us as drafting teachers.

Remember the Industrial Arts Ideal

We should bear in mind our training for the objective of exploration, as well as vocation; not all of our students will be or should be draftsmen, but all of them (as well as some others who may not now be enrolled but whose enrolment should be solicited) will benefit in many ways from a modicum of drafting instruction. Our courses should be sufficiently flexible to accommodate students who may be attracted to our clasess by a wide variety of motives. While some of our students may be surging surely ahead to the solid foundations of good draftsmanship, the bulk of them will benefit from our instruction in other ways. Some ways are listed below; astute instructors will think of many additional contributions:

1. Blueprint reading is and will be essential. At present, there is much clamor for workers who can read drawings. When civilian building is resumed, the need for workers trained in blueprint reading will be even greater. A wide background of experience will be helpful because building then will be on a broader front than that dictated by the narrow needs of defense industries. One way to learn to read drawings is to make them. Drafting is called for, but not the basic course which leads primarily to occupational training. The instructor should give as wide an experience in different types of drawings as the time available will allow.

2. Consumer education is a necessary and pleasant outgrowth of drafting study. A knowledge of the materials of machines, of their usual methods of assembly, and of the approved finishes, fits, and fastenings comes with work in machine drawing. It is apparent that any normal intellect would benefit from such learning opportunity and that a person who had been exposed for a period of time could do a better job of selecting machinery or tools for the home, office, or shop than if he had not had such an experience. As our civilization becomes increasingly mechanized, each individual will acquire more machinery. Let us keep before us this important need, and direct our students' minds toward it.

3. Training in and development of neatness and accuracy is one of the important accompaniments of drafting. Our adolescent and postadolescent students learn that "almost close enough" is not a satisfactory fit for modern machines, and that dirt, grime, and smudge accumulate on a clean drawing with the greatest of ease, and with disastrous results. A properly sharpened drawing pencil and a crisp T-square blade may inspire neatness. The inconvenience of hand washing, removal of soiled leather jackets, etc., to achieve a drawing worthy of these designers' tools is seen to be justified. The proper arrangement of these tools for efficient use, and the table orderliness of necessary handbooks and sketch pads may be the beginning of habits of orderliness and carry over into other aspects of the student's life. Closely akin to this are the concepts of accuracy and precision which are the foundation upon which our contemporary mechanization rests. In the drafting room there can be no compromise with accuracy of representation or of statement. Training in the checking of another's work is just as important as training in the development of accuracy in one's own work, and is a valuable adjunct to our teaching. Patience is the third part of this trio. It comes from a realization that usually an excellent drawing is a product completed after a prolonged series of class or other working sessions. Many young people want to finish a job at a sitting, or a single work period. With most drafting problems this cannot be done.

Care in the execution of drawings is a determining factor in the selection and hiring of draftsmen. While the vocational viewpoint may not influence some, it should be pointed out that most industrial jobs have these three things in common (neatness, accuracy, and patience) and that proficiency in one skill can be, and often is, transferred to another type of job.

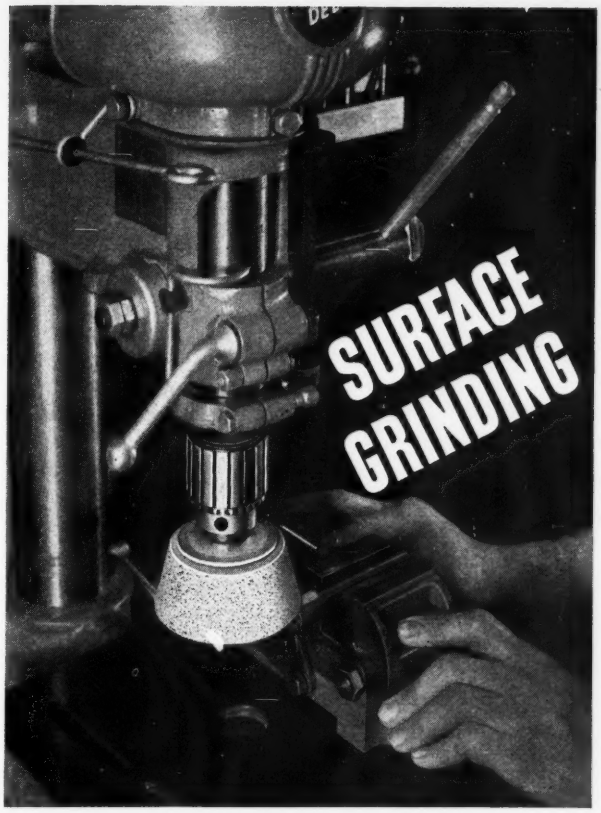
4. Drafting is the planning division. It is unthinkable that a student could work for several semesters, gaining ability in *making* plans and not see for himself the absolute need for *planning* for himself. In the world of tomorrow —the world of reconstruction—planning will take on added emphasis; plans for building, plans for government, plans for living. Let drafting point the way for thoughtful, intelligent, and complete planning for our students' futures.

Keep Professional in Attitude and Habits

1. We should be worthy of our position of importance by keeping up-to-date, by being aware of the latest trends in education in general, and in the teaching of drafting in particular—not in slavish emulation but to get right at the heart of the innovation and use the best of it. It is being conceded more generally that not everything which is new is good, or everything which is old is bad or outworn. So it is the part of wisdom to scrutinize everyone's story. Some are the same old tonics with new labels. There may be innovations which we would not choose to adopt, even in part, but we should be alive to their implications. Drafting teachers are in key positions to represent industrial arts at educational conferences and conventions. Let us be leaders, not merely equals, in our progressive outlook.

2. Even though some of us are reluctant to admit it, drafting is but one part, albeit a very important part, of the total training program for any given pupil. There are some very valuable people in our nation who probably cannot draw. That they would be even more valuable, given the skill of drafting, is beside the point. It is sufficient to acknowledge that there are other parts of

The palmy days of the present when facilities for teaching drafting are overtaxed may some day end. Here are some thoughts for tomorrow by a teacher in the John Burroughs Junior High School, Los Angeles, Calif.



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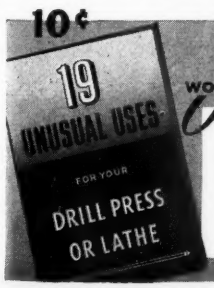

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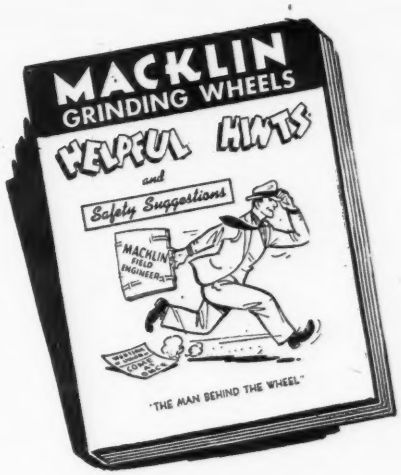

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the curriculum which contribute to the complete and satisfying training of our students. Do we see these parts in the proper perspective, not over emphasizing or under emphasizing their places? Let us be tolerant. Tolerance is usually an attitude of largeness; a characteristic of persons who have an inward assurance and ease, and a personality in which there is "a little more than enough."

3. Drafting itself has so many ramifications that we should not be impatient of the student who does not apply himself to our particular division of the science. Attitudes, skills, and habits founded in our classes will probably contribute largely toward success in allied fields; for example, sign painting, commercial art, industrial design, interior decoration, landscaping, and so on. All are fields in which the proficient use of T-square and ruling pen will contribute in no uncertain manner.

Work Interlude Valuable

Again, in the words of the Persian sage, "It's an ill wind that blows no one's apples down." The present period of activity presents much opportunity for remunerative work to young people who during other days might have stayed on in school. This work experience is likely to prove an unmitigated good if impossible obligations are not undertaken, precluding a return for more knowledge and training when the need is realized. In fact, this work period accords exactly with the recently released recommendation from the American Youth Commission of the American Council on Education, which feels that "every boy and girl should leave school temporarily for six months' experience at work after the twelfth or thirteenth grade." Right now the opportunities for work in drafting are so good that anyone who can hold a pencil is in great demand. The lure of paid work may act to reduce the numbers of our students. Later, during the slow-down, many of them will be thrown out of employment, and then our students may become discouraged at their prospects. In such an event we should point out that these workers have no adequate training, that they may be compared to the workers in a machine shop, most of whom are machine tenders, not machinists. These workers were not draftsmen, but merely delineators. The necessity of the times makes for extreme breakdown of jobs into comparatively simple and repetitive types which can be learned very quickly. Our young workers should not harbor the delusion that they are master craftsmen in any sense. When the extreme need has passed and the call for more knowledge is apparent, these former students can return and finish their education with a serious purpose, valuable experience, and maturity which will make their training more vital and their school work more practical than ever before. Then, as always, there will be "plenty of room at the top" after the full training has been completed.

Unanimity Will Help Our Position

Now is the time to confer and come to agreement on matters of policy and method. Although the democratic ideal of discussion is just as important now as ever, less haggling over details and less variance on minor issues is distinctly in order. Let us first be *united,* as drafting teachers, and, second, let us cooperate with our partners, the other shop teachers, who themselves need to introduce new projects because of their timeliness or their material necessity, and will most certainly need and welcome blueprints, drawings, and charts. Third, remember the teachers outside the shop; they need posters, charts, and diagrams. It is extra work, but it will store up treasures for us. Fourth, PTA activities offer opportunity for posters and signs. Here, again, we can do worse than lay up goodwill for our work and abilities. Fifth, we should intensely search out the value of our courses in the light of present mechanized civilization to discover (a) if the offerings are adequate and (b) if those to whom the offerings are made actually receive full benefits. Perusal of course outlines should uncover outmoded projects, standards, methods of drawing and of teaching. The question arises, do we render service to the total school population which can benefit from some generalized type of instruction such as girls who plan to major in dress design, interior decoration, home economics, etc., or other students who could profit from short-term instruction period to help them as chemists, etc.?

Increased Individualism and Selfreliance

Because of great demands of industry and a dearth of imported goods there is a problem in getting some of the scarcer materials with which to continue our instruction. A spirit of self-reliance and adequacy will think up ways of using substitute supplies which will not interfere with education.

Above all, if in these troubled times we can make an example of our teaching lives so that our students will accept and make habits of the attitudes and ideals we preach, not by words but by actions—honesty, sincerity, courage, tolerance, sympathy, patience, and understanding—we will win and keep the confidence and respect of our students and colleagues, and hold a place for drafting in the curriculum of tomorrow.

Radio . . . *(Continued from page 14)*

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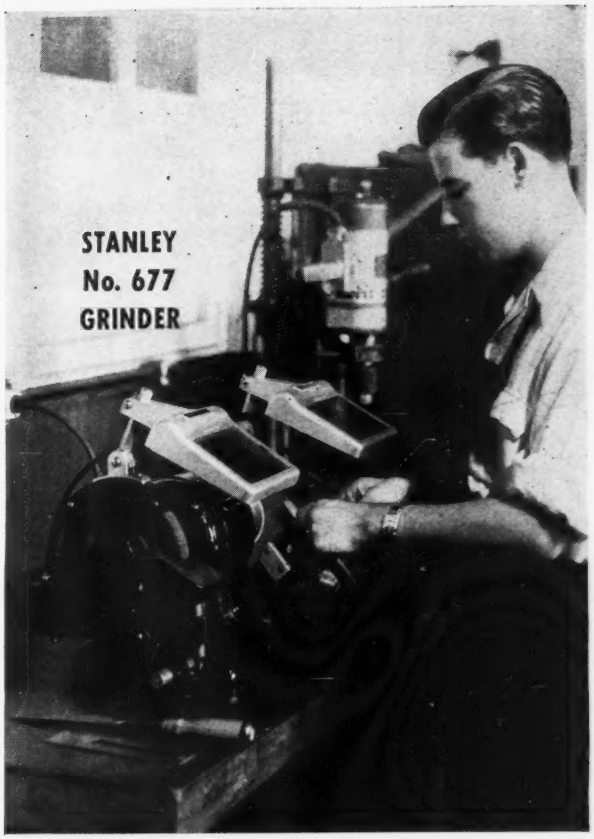

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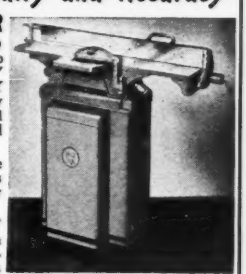

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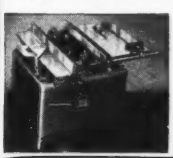

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Tail Wheels for Model Airplanes

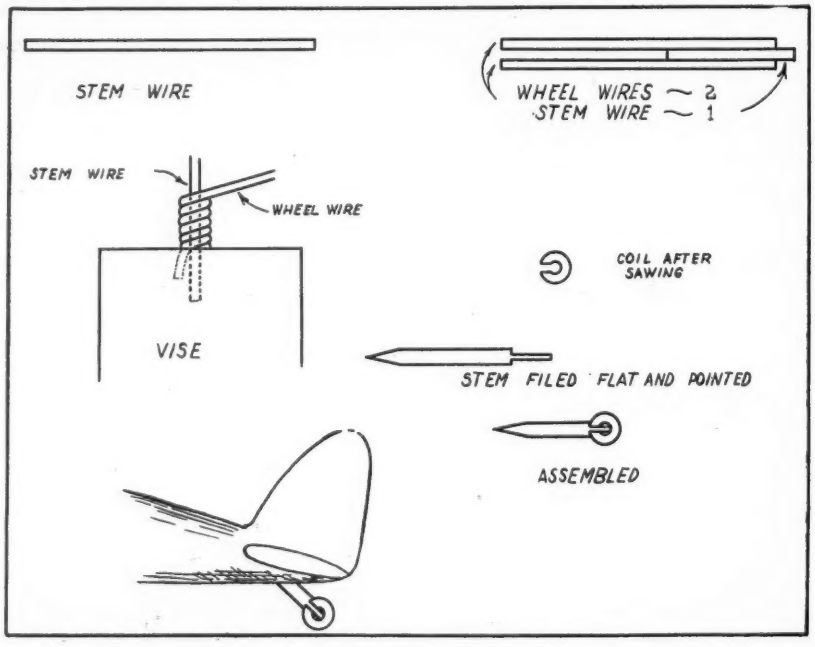
BY *L. S. Watson*

Shop instructors who are responsible for model-building activity will welcome this solution to the problem of building wheels. The author teaches industrial arts at South Junior High School, Niagara Falls, New York

TESTED INSTRUCTIONAL PROJECT

CONSIDERABLE difficulty was found when attempting to make the tail wheels for the model bomber for the War Department, due largely to breakage. To overcome this we decided to use metal. After using all methods including filing, casting in jeweler's sand, and beveling, we hit on the method of using wire. The following steps indicate the simplicity of the method:

1. Select the wire which will give the correct stem size.
2. Select the wire which will give the correct wheel size when twice its diameter is added to the stem size.
3. Take the second piece of wire about 12" long and wind it around the first piece as when making a spring.
4. After making several loops or turns remove center wire and saw the loops lengthwise of the coil.
5. Remove all burrs.
6. Now cut number one wire the correct length to allow joining to the body.
7. File one end to a point.
8. File the other end to make a force fit in the saw slot of the cut off coils.
9. Flatten the twist of the coil and press the stem into the saw cut. Note that the assembly may be sweat soldered if necessary.
10. Bend stem to the correct angle, if necessary.



news

WHAT'S DOING IN THE FIELD OF INDUSTRIAL EDUCATION

ARRANGEMENTS are coming along rapidly for the Chicago Wartime Vocational Training Conference of the American Vocational Association, according to L. H. Dennis, Executive Secretary. The conference is to open with various section meetings on Wednesday morning, December 15, and will close Friday afternoon, December 17, early enough to allow members to catch afternoon trains. The theme of the conference is "Gearing Vocational and Industrial Arts Education to War and Post-War Needs." This means, according to Mr. Dennis, that definite attention will be paid to post-war planning. Chicago is planning a substantial educational exhibit which along with the commercial exhibits will be held in the Exhibition Hall of the Palmer House. Meetings will be scheduled about equally between the Palmer House and the Morrison Hotel with the banquet to be held Wednesday at the Morrison. The state directors of vocational education will hold their sessions December 13 and 14 in the Palmer House. Various state supervisor and teacher-trainer groups will meet on Monday and Tuesday, December 13 and 14, in the Morrison Hotel as will also city directors and trade-school principals. The meeting has been streamlined generally and moved into the middle of the week to avoid week-end railroad and bus travel as much as possible.

RAPID changes in the technical aspects of industry and the increasing demand for trained technicians have led to the appointment of a Consulting Committee on Vocational Technical Training by Commissioner John W. Studebaker of the U. S. Office of Education. The committee is to gather information on technical training programs of the technical institute type. Trained technologists are needed in such industrial fields as aviation, electronics, and synthetics for work not requiring men who possess professional degrees. J. C. Wright, Assistant U. S. Commissioner for Vocational Education, is chairman of the committee which numbers 26 members. Lynn A. Emerson, professor of industrial education, Cornell University, is secretary. Others from the field of industrial education include M. R. Bass, St. Louis, Mo.; Howard Campion, Los Angeles, Calif.; L. H. Dennis, Washington, D.C.; Oakley Furney, Albany, N.Y.; L. S. Hawkins, Washington, D.C.; John A. McCarthy, Trenton, N.J.; Clarence E. Rakestraw, Washington, D.C.; William F. Rasche, Milwaukee, Wis.; and Robert H. Spahr, Flint, Mich.

CERTAIN aeronautical equipment for instructional purposes (exclusive of flight) is available for distribution to pre-flight aeronautics classes in secondary schools. For particulars and application forms address the Department of Commerce, Civil Aeronautics Administration, Pre-Flight Aeronautics Program, Washington, D.C.

THE Army-Navy "E" has been awarded to the Carboloy Co., Inc., Detroit, the nation's major producer of cemented tungsten carbide cutting tools and dies, and to the Chicago Wheel and Mfg. Co., Chicago, Ill., producers of small grinding and mounted wheels.

THE Brooklyn Guild of Teachers of Shop of New York City has elected the following officers for 1943-44: John M. Hurley, reelected president; Stanley Weber, vice-president; Louis R. Krassner, corresponding secretary; William P. Davis, financial secretary; Abe Beckman, recording secretary; and Philip Weisbard, treasurer.

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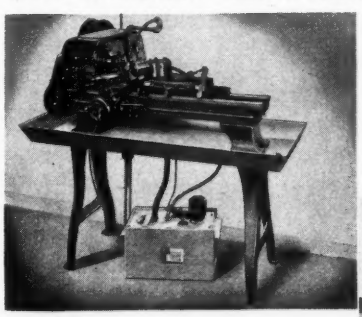
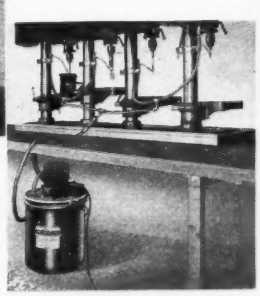


Left: Lathe set in Flow-Bac-Pan, served by "A" Series Model.

Below: A 4 Spindel Drill Press, with G-3 "A" System.



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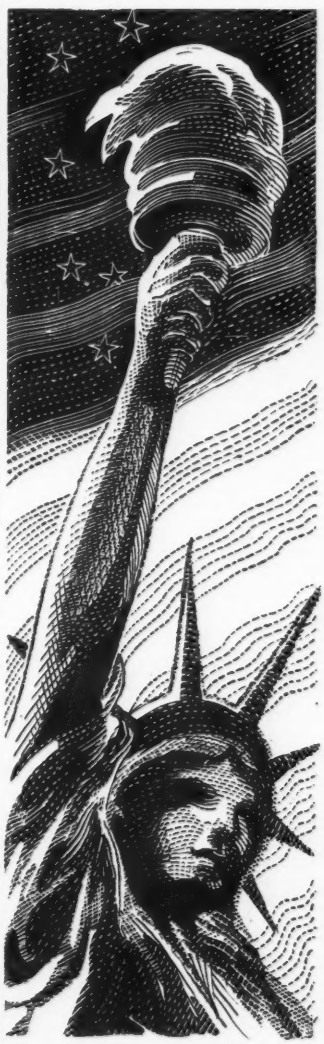

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INSTRUCTIONAL RESOURCES

Inquiries concerning materials described in these columns may be addressed to SCHOOL SHOP, Box 100, Ann Arbor, Mich.

Basic Electricity for Communications. Timbie. New York: John Wiley & Sons, 1943. Pp. ix+603. $3.50.

Timbie's book goes beyond discussion of basic theory into the practical application of the theory pertinent to the fields of communication and industrial electronics. Problems are given throughout the text. Diagrams, illustrations, charts, index.

William H. Timbie is professor of electrical engineering and industrial practice at Massachusetts Institute of Technology. He is also author of several other books on electricity.

Files—How to Select, Use, and Conserve Them. Philadelphia: Delta File Works, 1943. Pp. 28. No charge.

This pamphlet discusses with illustrations the best way of getting the most out of files, stressing safety and tool conservation. Information also on types of files and how they cut.

Available on request from the manufacturer or from SCHOOL SHOP.

Industrial Safety. Roland P. Blake, editor. New York: Prentice-Hall, Inc., 1943. Pp. X + 435. $3.75.

Eight men with long experience in industrial safety engineering contribute to this volume. The 31 chapters deal with such subjects as: Analyzing Causes of Accidents, Fundamentals of Accident Prevention, Accident Investigation, Low Voltage Electrical Hazards, Guarding of Woodworking Machines, Methods of Promoting Safe Practice. Henry T. Heald, president of Illinois Institute of Technology, is author of the foreword.

Editor Blake is senior safety engineer in the Division of Labor Standards of the U. S. Department of Labor. The co-authors are: J. J. Bloomfield, sanitary engineer, and R. T. Page, assistant sanitary engineer, U. S. Public Health Service; S. W. Homan, safety engineer, Children's Bureau, U. S. Department of Labor; T. O. Armstrong, manager, Industrial Relations, Westinghouse Electric and Manufacturing Company; C. B. Boulet, director of personnel, Wisconsin Public Service Corporation; W. Dean Keefer, second vice-president, Lumbermen's Mutual Casualty Company; and M. A. Gimbel, safety engineer, General Electric Company, Philadelphia Works.

Blue Print Reading. Hobart. New York: Harper and Brothers, 1943. Pp. 121. Paper bound. $1.

This course of study, in 37 articles and 28 full-page problems, is a revision of *Notes and Problems in Blue Print Reading*, published in 1941. The course is designed to train the student quickly, and the scheme, tested by the author at General Motors Institute, was found to be as effective as a slower method used earlier. The book has 110 illustrations.

D. E. Hobart is associate professor of mechanism and engineering drawing at the University of Michigan.

Applied Mathematics for Technical Students. Corrington. New York: Harper and Brothers, 1943. Pp. IX + 226. $2.20.

Written as part of a program of the Rochester Athenaeum and Mechanics Institute for developing teaching materials of a practical nature closely related to actual requirements of various jobs in industry. Arithmetic, algebra, logarithms, and trigonometry with applications are the subjects of its seven chapters. Although it is designed as a textbook for trade schools, factory training courses, or pre-engineering studies, it is sufficiently complete for home-study use. Answers, index.

Murlan S. Corrington was formerly of the Rochester Athenaeum and Mechanics Institute and is now radio engineer, Advanced Development Division, Radio Corporation of America, RCA Victor Division.

Metalwork Technology and Practice. Ludwig. Bloomington, Ill.: McKnight and McKnight, 1943. Pp. 397. $4.

A manual furnishing elementary information in metalwork, including description of tools, materials, operations in machine-shop trades, automotive and aeronautical work, metal patternmaking, foundry work, sheetmetal trades, metal-building trades, ornamental metalwork, electrical trades, and industrial manufacturing. Arranged in 57 units for teaching purposes, each unit concludes with a review, suggestions for coordinating other subjects such as mathematics, drafting, vocabulary, social science, and exercises under the heading of Occupational Information. More than 600 illustrations, a 19-page index, and a detailed description of how to use the manual.

Oswald A. Ludwig is department head of vocational education at the Munger Junior Trade School, Detroit.

Gas Welding. Staff of Dunwoody Industrial Institute. Chicago: American Technical Society, 1942. Pp. 92. $1.25.

A manual providing instruction in 40 training jobs. A job sheet, accompanying each of the first 28 jobs, outlines the job assigned, lists equipment required, provides general instruction and precautions, suggests operating steps, gives directions for testing the job when completed, and gives review questions for the student for study after the job has been satisfactorily completed. With each job sheet is a job information sheet which instructs the student on how to do the task and gives him reasons for doing it in the manner directed.

The manual is the second in the Dunwoody Series in Welding Training Jobs, the first one being *Arc Welding Manual.*

Shop Mathematics. Dick. New York: The Ronald Press Company, 1943. Pp. XIV + 230. $2.40.

A text on related mathematics for industrial subjects planned for high-school shop and vocational courses. The book is organized into teaching units and assignments in a definite sequential order. Ten tables, 66 illustrations, index.

Arthur A. Dick is coordinator of vocational war production training for Baltimore County, Maryland.

The Student Planning Book for Industrial Arts and Vocational Classes. Baysinger and Silvius. Scranton: International Textbook Company, 1943. Pp. 64. Paper bound. 30c.

This revised edition of a handbook for classes in school shops is designed to assist students to participate in the planning of the work they are to do through a pupil-personnel organization, which is proposed as an instructional plan by which students assume the responsibilities of shop or laboratory routines. The workbook is based on the idea that the ability to organize work and to get along with others is as important as the ability to do the work. The first part of the workbook (17 pages) is given over to the shop organization and responsibilities students are to assume and the procedures for planning a project. The remainder of the book provides the forms for school-shop projects on which the student lists materials and tools, records book references, draws details of the project. Space for student organization and instructor evaluation is provided on each form.

Gerald B. Baysinger is a teacher in the industrial arts department of Mackenzie High School, Detroit, Mich., and G. Harold Silvius is assistant professor of industrial education, Wayne University and assistant supervisor of vocational education of the Detroit Public Schools. The book is edited by Earl L. Bedell, director of vocational education of the Detroit Public Schools.

Methods of Measurement. Cornetet. Bloomington, Ill.: McKnight and McKnight, 1942. Pp. 135. Paper bound. 80 cents.

The first of a series of five books in the Related Shop Science Series, this text acquaints the student with the best recognized procedures in measuring methods. It has 118 illustrations and 39 tables as well as an appendix of reference tables. The use of calipers is discussed in detail. Chapters on the manufacture and measurement of nails and screws are provided. Weights and volumes, measuring density of liquids and solids, determining specific gravity of solids and liquids, measuring of elasticity and determining the special properties of metals, and the measuring of temperature and of heat and determining coefficient of linear expansion are subjects discussed.

Wendell H. Cornetet is head of the department of vocational science of the East Huntington Trades School, Huntington, West Virginia.

Sound Films and Visual Learning Guides. Minneapolis: Department of Technical Training, Doall Trade School. Pp. 12. Paper bound. Free.

This pamphlet lists 35 sound films which illustrate the use of machines and shop operations. Description of film, source, size, type, and price are provided. Listed are films on such subjects as: Fundamentals of Hand

Filing, Precision Layout and Measurement, Cutting Tools, Height Gages and Test Indicators, The Micrometer, Dies and Diemaking, Lathe Operations, Scraping Flat Surfaces, Cutting a National Fine Thread.

Mathematics Essential to Electricity and Radio. Cooke and Orleans. New York: McGraw-Hill Book Company, Inc., 1943. Pp. X + 418. $2.40.

An adaptation of Cooke's *Mathematics for Electricians and Radiomen* to the secondary school level and to high-school teaching technics. The first seven chapters serve as a review of mathematics, while the remaining 23 chapters are given over to the application of mathematics to radio and electric circuit theory. Appendix, including common logarithms tables and natural sines, cosines, and tangents tables. Index and answers to exercises and problems.

Nelson M. Cooke is a Lieutenant in the United States Navy and a member of the Institute of Radio Engineers. Joseph B. Orleans is head of the department of mathematics, George Washington High School, New York City.

IN THE Morning Mail . .

[Brief comments about SCHOOL SHOP and the field it serves are invited. Address the Editor, SCHOOL SHOP, Ann Arbor, Michigan.

Dear Sir:

May I congratulate you and your staff for the very excellent material that you publish in your magazine. The first one in the current number is particularly timely as the boys are increasingly interested in building flying models in the regular class periods of wood shop.

My experience with model building groups dates back to 1934 and 1935 and it is interesting to note the improvement of the standards of the kits offered for sale over this period.

Your paper has a very definite message for each department in the field of industrial arts and vocational education. Furthermore, one can read it from cover to cover in a short time. I find that I look forward to receiving it each month with a great deal of pleasure and profit.

HAROLD K. ANDERSON,
Vice-President, New England Industrial Arts Teachers' Association, Cranston, R. I.

Gentlemen:

It has been a pleasure for our shop teachers to receive your publication, SCHOOL SHOP. We all look forward to each copy,

In order that your mailing list may be correct, we are enclosing some recent staff changes.

I am sure that these men will be glad to receive SCHOOL SHOP. For myself and the other men, please accept our thanks.

I. E. LANE, High School,
East Bakersfield, California

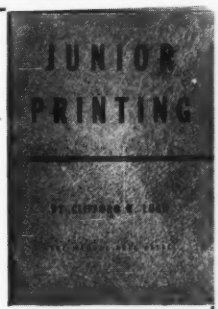
[Many thanks for the list of staff changes and the subjects taught by the new men. SCHOOL SHOP is very appreciative of this cooperation and welcomes lists of faculty changes in order to keep its records clear.—*Ed.*]

"They'll all be using"

JUNIOR PRINTING

By CLIFFORD K. LUSH
Supervisor Ind. Arts, Mpls., Minn.

If you have anything to do with junior-high-school printing or are interested at all in the course at your school or schools, you can't go wrong by putting your influence behind this new simplified textbook-workbook. So attractive and easy to use that it will actually advertise the course among other students. Proved through repeated tryouts in the Minneapolis school system. *While it is still fresh in your mind, send for an on-approval copy of this original text today!*



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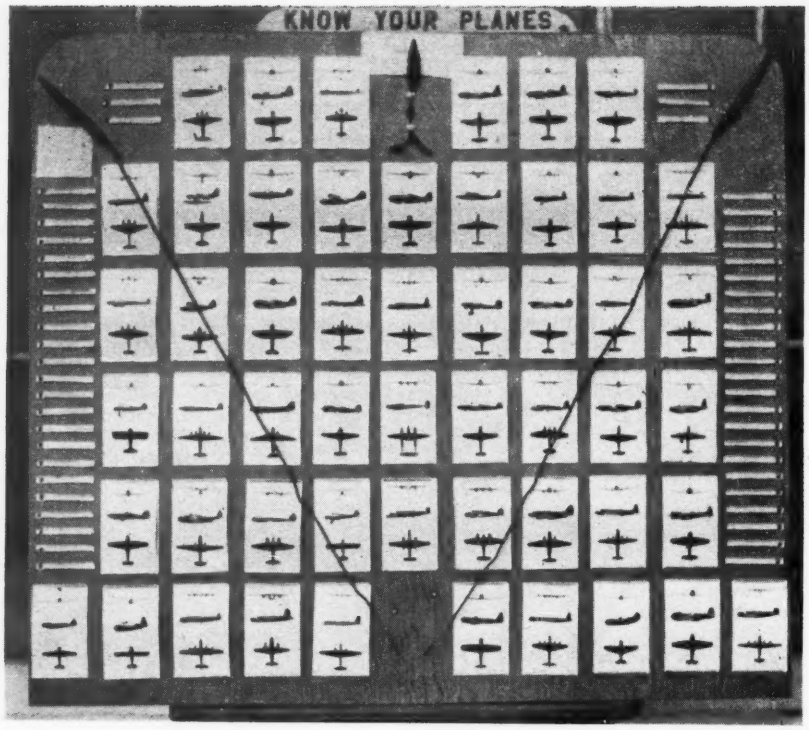
Plane Identification Aid

BY *Stanley J. Drazek*
LIBERTY, N. Y., HIGH SCHOOL



TESTED PROJECT

THIS project, developed in the Liberty High School's Industrial Laboratories has aided greatly in the identification of planes among the observers of the local Air Spotting Post, Boy Scout groups, students throughout the school, and towns, people in general.

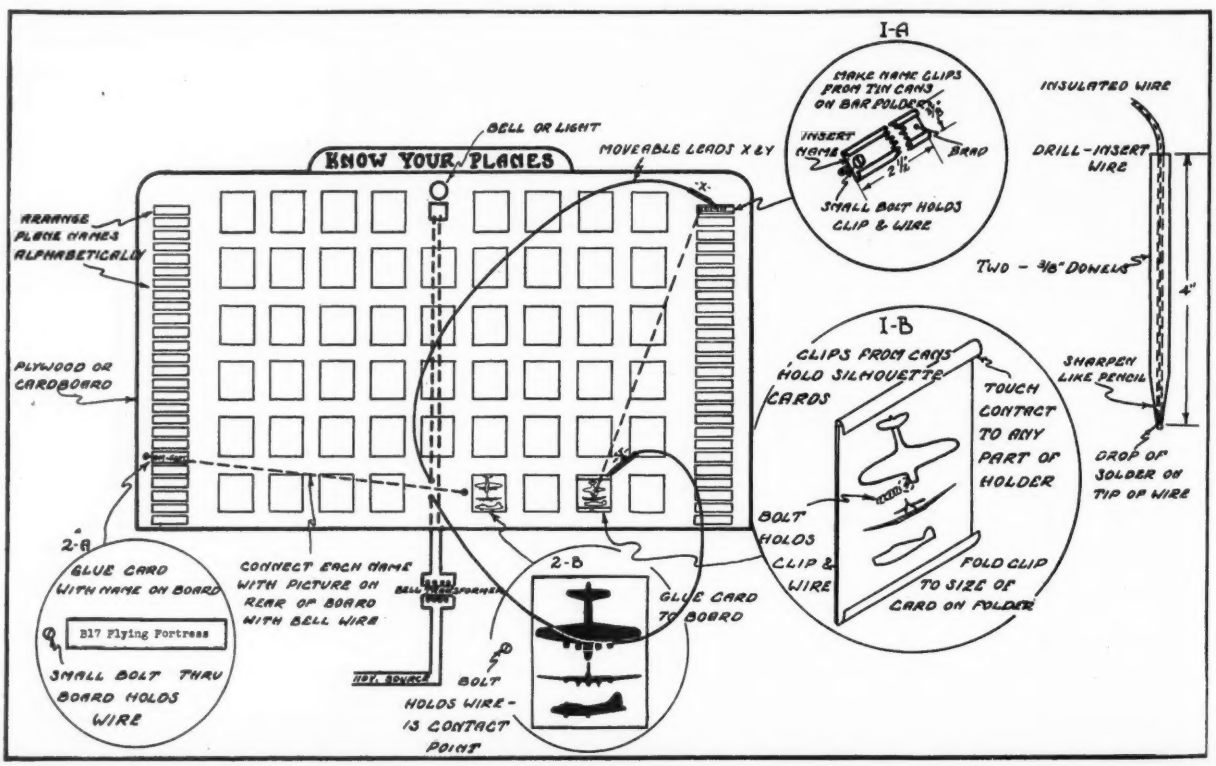
To see whether a person can identify planes, he merely has to contact one movable lead against the name of the plane and the other to the corresponding silhouette. If the correct name and silhouette are matched a circuit is completed which rings a bell or lights a bulb, whichever is connected in the circuit. When incorrect combinations are tried there will be no response. When mounted at the Liberty Observation Post, people spent many hours testing their skill.

Silhouettes of planes may be obtained from many sources such as air spotting magazines, books, and various publishers. The size of the board is dependent on the number and size of silhouettes to be mounted.

As illustrated in the drawing, two methods of mounting the planes may be employed. Method 1-A and 1-B allows for changing of planes and names with a maximum of ease by merely sliding out those already learned and sliding in new ones. Method 2-A and 2-B requires less work and materials but does not allow for easy changes to be made.

The wiring is very simple as shown by the hookups of the two silhouettes in the drawing. No. 18 bell wire may be employed throughout except for the contact leads which should be heavier to withstand the flexing they will be subjected to.

The entire project may easily be built from salvaged materials and its entire cost will be negligible. This particular one was built by junior high boys ranging from 12 to 15 years in age.


I-A
MAKE NAME CLIPS FROM TIN CANS ON BAR FOLDER
INSERT NAME
BRAD
SMALL BOLT HOLDS CLIP & WIRE
INSULATED WIRE
DRILL - INSERT WIRE
TWO - 3/16" DOWELS
4"
BELL OR LIGHT
MOVEABLE LEADS X & Y
KNOW YOUR PLANES
ARRANGE PLANE NAMES ALPHABETICALLY
PLYWOOD OR CARDBOARD
I-B
CLIPS FROM CANS HOLD SILHOUETTE CARDS
TOUCH CONTACT TO ANY PART OF HOLDER
SHARPEN LIKE PENCIL
DROP OF SOLDER ON TIP OF WIRE
BOLT HOLDS CLIP & WIRE
FOLD CLIP TO SIZE OF CARD ON FOLDER
2-A
GLUE CARD WITH NAME ON BOARD
B17 Flying Fortress
SMALL BOLT THRU BOARD HOLDS WIRE
CONNECT EACH NAME WITH PICTURE ON REAR OF BOARD WITH BELL WIRE
2-B
GLUE CARD TO BOARD
BOLT HOLDS WIRE - IS CONTACT POINT

ONE THING FOR SALE ...THREE FOLKS TO BUY
AND SO THE PRICE GOES UP SKYHIGH!
WITH PRICES HIGH YOU WANT A RAISE -
THAT STARTS A GREATER SPENDING CRAZE!
UP
UP
UP
UP
UP
THIS CRAZY WHIRL IS CALLED INFLATION
AND IT ALONE CAN WRECK A NATION!
LET'S ALL STOP PRICES GOING HIGHER
BE A SAVER - NOT A BUYER!

Seven things you should do:

1. Buy only what you really need	**2.** Pay no more than ceiling prices... buy rationed goods only with stamps	**3.** Pay off old debts and avoid making new ones	**4.** Support higher taxes ...pay them willingly	**5.** Provide for the future with adequate life insurance and savings	**6.** Don't ask more money for goods you sell or work you do	**7.** Buy all the War Bonds you can afford – and keep them

Keep prices down...use it up, wear it out, make it do, or do without

This advertisement, prepared by the War Advertising Council, is contributed by this magazine in cooperation with the Magazine Publishers of America.

. . . news from INDUSTRY

TRAINING AID FOR ELECTRICITY

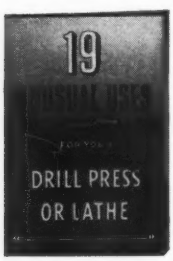
A new teaching apparatus which can be assembled into 40 different types of rotating electrical machines is now offered at low cost by the Universal Scientific Co., Inc.

This machine, designed for teaching purposes, has all parts visible and accessible. It illustrates motors, generators, and alternators, and can be set up as a self-synchronous motor, dynamotor, sine-wave device, rotary variable transformer, and induction feed-regulator.

The same basic parts are used in every experiment; it is necessary to change only the position or type of the poles and coils. Literature: Universal Scientific Co., Inc., Vincennes, Ind., *or check number 21 below.*

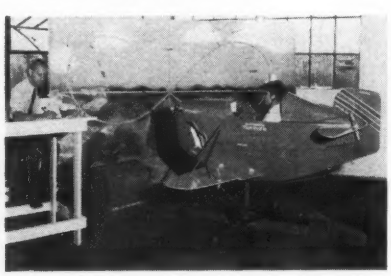
BOOKLET OFFERED BY JACOBS MFG. CO.

19 Unusual Uses for the Drill Press and Lathe is the title of a new booklet published for those interested in adapting their lathe or drill press to unusual operations. The booklet gives detailed information and photographs of set-ups showing attachments for such operations as making square and rectangular holes with a hollow chisel mortiser attachment, surface grinding with a wheel cup, and many others.



Printed in color and contains 49 illustrations. Available at a cost of 10c to cover handling and postage from Jacobs Mfg. Co., Dept. SS, Hartford, Conn., *or check number 22 below.*

PILOT TRAINER FOR CLASSROOM USE



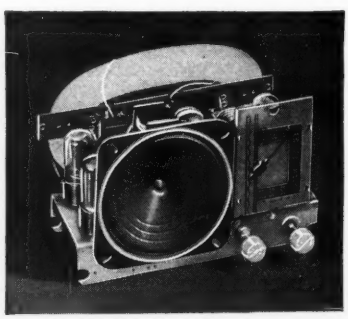
The new "J-17" Classroom Trainer, designed to simulate the actual conditions of flight, teach coordination of controls, navigation, and "blind-flying," is now available from the California Aero Glider Co. It performs loops, dives, stalls, banks, climbs, and turns similar to actual flying.

The trainer, built of nonstrategic materials, has an 8′ wing span and 8′ fuselage length. Mounted on a pedestal and ball-bearing axis 2′ above the floor, it is turned in either direction when the electric motor-driven propeller is actuated by the rudder pedals. The fore, aft, and lateral movements are actuated by cable controls inter-connected with springs to give "air feel." Aileron, elevator, and rudder controls operate just as they would through the slipstream of flight. Write California Aero Glider Co., 1829 West 62nd St., Los Angeles, Calif., *or check number 23 below.*

MODERN RADIO RECEIVER KIT

A modern radio receiver kit designed to permit the progressive study of such basic receiver subjects as rectification, filtering, detection, RF, IF, and AF amplifications has been produced by the Allied Radio Corp. It is available to all schools and colleges conducting war-training programs.

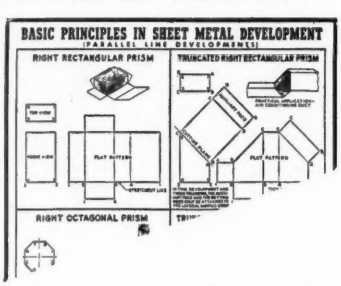
This 5-tube kit consists of all necessary



parts; the chassis is completely formed, punched, and rust-proof; and only a screwdriver, pliers, and soldering iron are needed for assembly. The circuit includes many outstanding and up-to-the-minute features. Literature: Allied Radio Corp., Educational Division, 833 Jackson Blvd., Chicago 7, Ill., *or check number 24 below.*

NEW CHART OFFERED BY EBERHARD FABER

"Basic Principles in Sheet Metal Development" is the title of a new wall chart offered to teachers by Eberhard Faber Pencil Co. The chart, measuring 16½" by 27½", is made of durable and washable material.



Shown on the chart are standards for parallel line developments including simple and truncated right rectangular prisms, simple and truncated right octagonal prisms, and simple and truncated right circular cylinders.

This chart is not available for student distribution, but teacher's copies may be had without charge by addressing Eberhard Faber Pencil Co., Dept. SS, 37 Greenpoint Ave., Brooklyn, N.Y., *or by checking number 25 below.*

TURNING TIPS FOR TRAINEES

A new teaching aid for lathe operators, "Turning Tips for Trainees" is now being offered to shop instructors and students by the LeBlond Machine Tool Co. Originally written for lathe operators in defense industries, this set of tips is now available without cost to the schools.

Easily understood and graphically illustrated, these sets are a valuable supplement to shop instruction. Specify the number of sets desired. LeBlond Machine Tool Co., Cincinnati 8, Ohio, *or check number 26 below.*

DEVELOPING SOLUTION ELIMINATES "BLUEPRINT RASH"

Hi-Tense Concentrate, a new blueprint developing solution produced by the Wisconsin Pharmacal Co., eliminates the discomfort of blue-print operators who are allergic to ordinary potash solutions. It is nonirritating to hands, noncorrosive to tank linings, and nonstaining to clothing. It also makes sharper blueprints, free from brown spots.

A pint bottle of Hi-Tense, diluted with water in a ratio of 1 to 320, will make 40 gallons of solution. For information write Wisconsin Pharmacal Co., Milwaukee, Wis., *or check number 27 below.*

New Literature . . . . .

"Soft Texture" lumber. Industrial Arts, Fine Arts, Automotive Supplies, and other equipment plus priority information are described in the 14th annual catalog from Brodhead-Garrett Co., Inc., Cleveland 5, Ohio, *or check number 28 below.*

Each item listed above is numbered. Check the numbers of the items you want, and mail the coupon, properly filled in, to . . .

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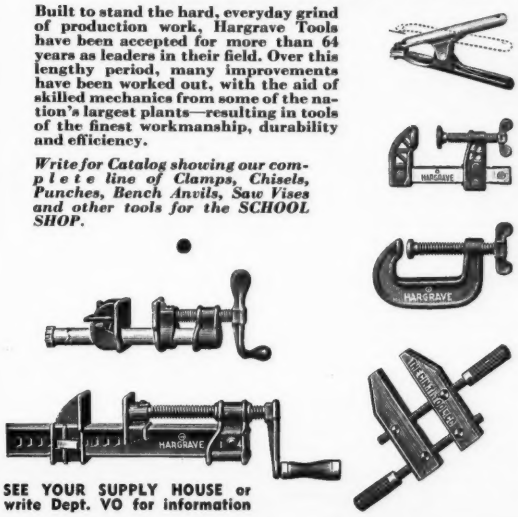

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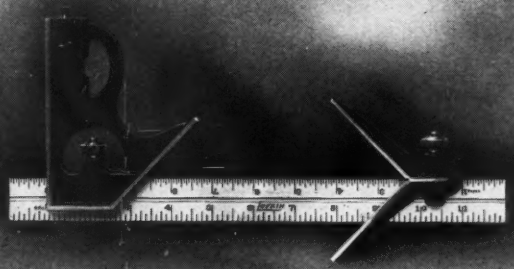
Every School Shop needs this versatile tool



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This precision built tool, consisting of a tempered, machine-divided blade with square and center heads (cast or drop-forged) has so many varied uses as to be virtually indispensable to all mechanics working with metals.

Heads can be securely set quickly and accurately. Square heads have level glass and steel scriber. Graduated English or metric.

. . . Teach Good Workmanship With Good Tools . . .

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TAPES · RULES · PRECISION TOOLS

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SCHOOL SHOP is looking for good manuscripts that will be of practical help to teachers of shop subjects. Material is needed in the new fields which preinduction training has emphasized as well as in the customary subjects. Fields in which material is particularly sought are

Radio	*Woodworking*
Electricity	*Sheetmetal*
Machine Shop	*Aviation*

Please emphasize the instructional values of project material. Send in clear glossy photographs and good working drawings in ink on white paper. Articles are paid for at regular space rates. Send them to

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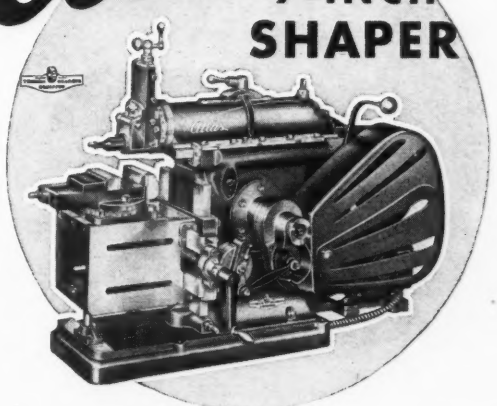
Atlas 7-INCH SHAPER



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O'NEIL-IRWIN DI-ACRO MFG. CO. 355 Eighth Ave. So. Minneapolis 15, Minn.

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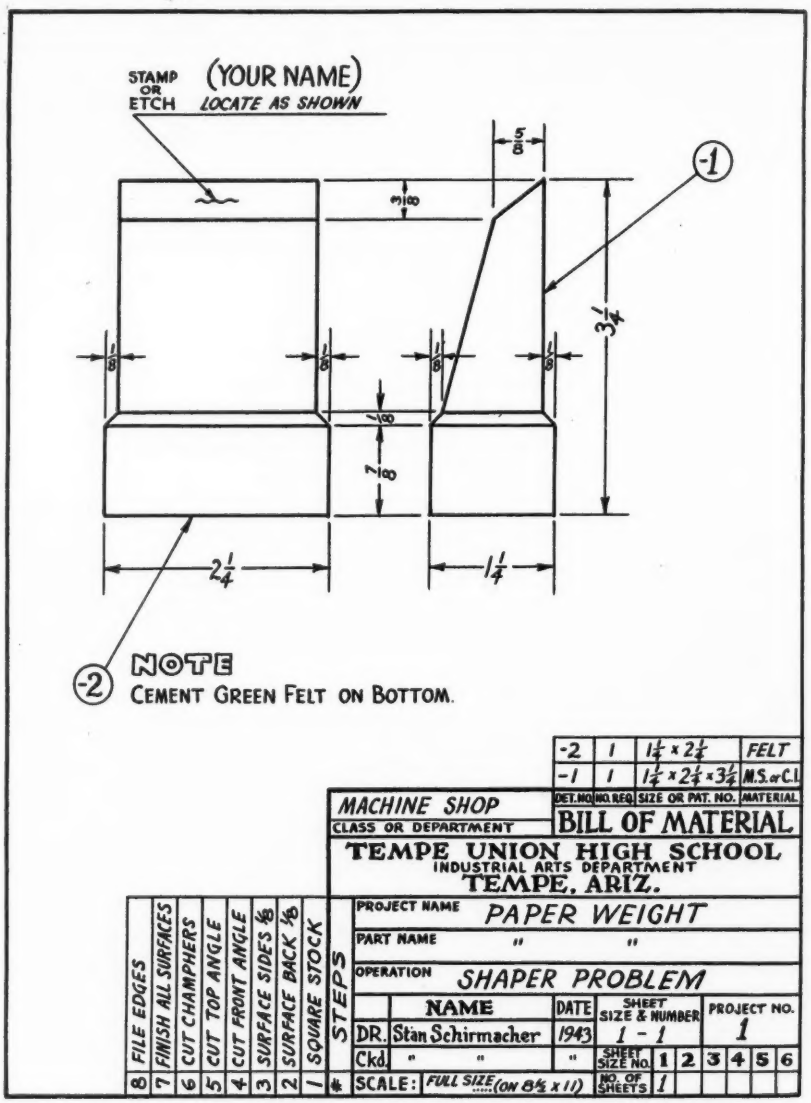

from Washington

(Continued from page 32)

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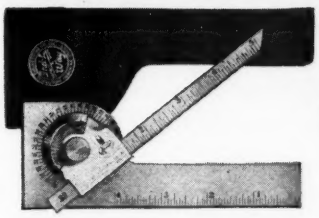

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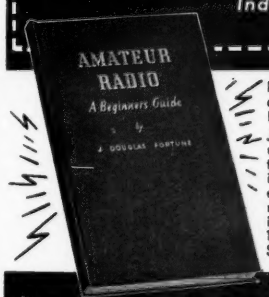

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DIRECTLY across from the White House, near Lafayette Square, is the temple-like building of the United States Chamber of Commerce.

Out of its offices comes a startling proposal for vocational education which will probably be talked about for months to come.

It is made by Thomas C. Boushall, Virginia banker and head of the Chamber's committee on education.

If vocational and industrial education, says Mr. Boushall in effect, will undertake to train large numbers of boys and girls to operate high-powered modern machinery, business will be willing to meet the costs of such training.

To state it thus baldly is perhaps not to do justice to Mr. Boushall's suggestion. For, he grounds it upon large national needs—needs which can be met if vocational education will accept this challenge of business. First, says Mr. Boushall, there is the need to reduce the postwar debt, which will probably mount to some 300 billion dollars before the war ends. (We ended the First World War with a debt of only 26 billion.) Second, there is the need to increase our national wealth, which can be done only if large numbers of skilled hands are at work. Third, we should preserve our markets in lands all over the world. But we have to meet these needs, says Mr. Boushall, by economically-sound means; in other words, by methods which can be paid for as we go along without creating deficits for the future.

It is at this point that Mr. Boushall makes the most startling part of his suggestion. He says that a six-cent tax has once before in our history created a rich and enriched economy. He is referring to the six-cent gasoline tax (on an average) imposed throughout the United States. It is this tax, Mr. Boushall thinks, which has built the matchless system of American roads, in turn encouraging the development of the automobile and bringing an era of great social progress. Why couldn't business tax itself six cents for every employee in each establishment and farm to pay for a vast training program of highly skilled workers? Such workers will be able to create great national wealth, pay off our national debt, and compete successfully with other nations for foreign markets.

In short, the U. S. Chamber of Commerce would like to see vocational education go into partnership with business. "Healthy brawn," says Mr. Boushall, "directed by skilled brain operating multiple units of high-powered machinery is the potential product of the combination of the statesmanship of American education and the genius of American business."

This proposal has already been brought to the attention of a number of educators, including a Conference on Business Education, held at New York University. Some of the educators who heard this suggestion called it "the most original idea on education in a 100 years."

However, Washington educators are asking questions about this notion. The first of which is: Should problems of postwar debts and international markets influence the objectives of education? Is "healthy brawn operating multiple units of high-powered machinery" the goal of education? Can education go into partnership with business at the exclusion of other groups? What will be labor's reaction to such a partnership? Is business willing to bear the costs only of a program to "condition" youth to run machines or also of a truly broad industrial arts and liberal education as well?

The U. S. Chamber of Commerce will probably be asked to answer these and other questions before vocational education will enter the partnership proposed by Mr. Boushall.

● Exchange of American industrial arts and vocational educators with foreign countries is high on the agenda of the proposed International Organization for Education and Cultural Development.

The International Organization for Education was conceived at Harpers Ferry, West Virginia, last month at one of the most important educational conclaves of the year. Present were some 50 American educators and foreign representatives from more than a score of nations.

Whether from China or Poland, the foreign delegates told a strikingly similar story of Axis strategy toward their invaded countries: to destroy all traces of technical education among conquered peoples. Equipment of school shops and technical institutes of one invaded country after another was stolen and carted off to Germany. Technical books were burned or carried off. Shop teachers, together with other educators, were put into concentration camps, arrested, or placed under Gestapo supervision.

The purpose of Axis militarists is to deprive their victims of technical skills and tools. "Slaves need no skills," taunted the Nazis.

The answer given by the international assembly of education at Harpers Ferry was: "Technical competency is the trademark of free men!" Hence, the assembly proposed that an international education organization shall encourage widespread technical education among all nations—many of whom, like Poland, Yugoslavia, and Hungary, have been deprived of such opportunities even before the days of Hitler.

Each foreign delegate insisted that his or her country will want to do its own educational reconstruction job, but that each country will want considerable help.

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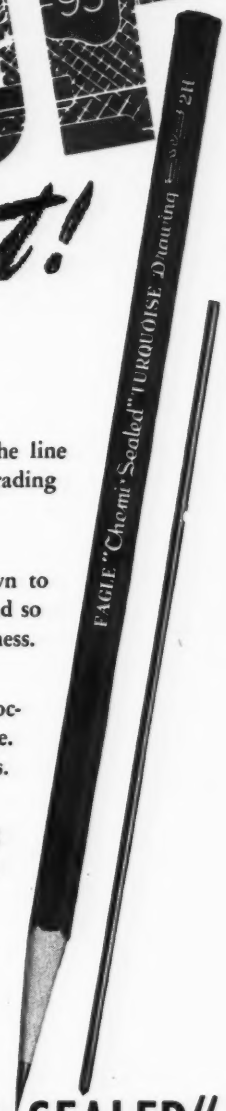

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